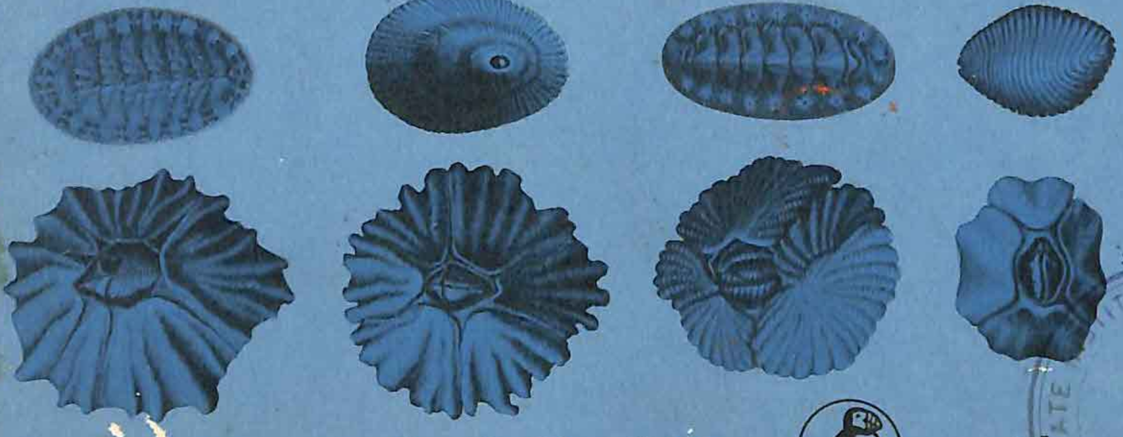
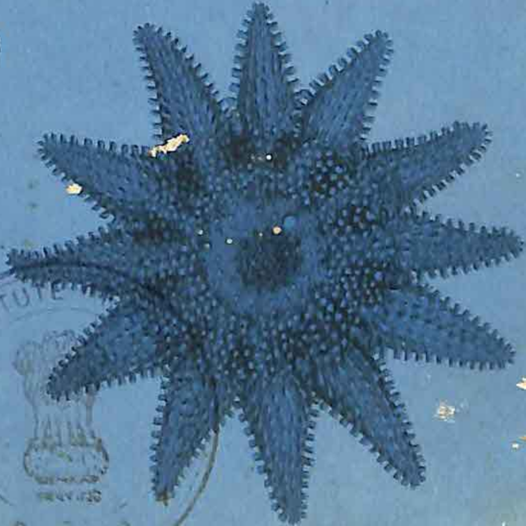
2076

Seashore Life

by Gillian Matthews and Peter Parks





Puffin Picture Book No. 120

5/-

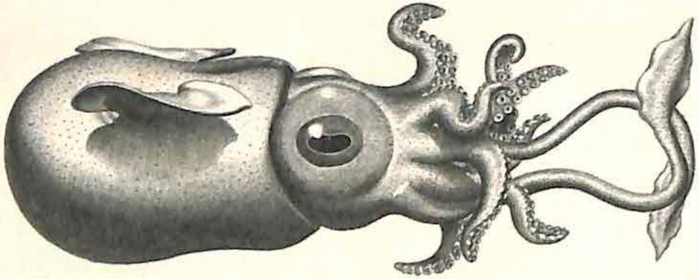
Exploring the Seashore

The shore is the home of a very large number of plants and animals. This book will help you to recognize some of them although there are so many to be found and so many interesting things to know about them that it would take a library of books to deal with them fully.

You will discover that many shore plants and animals are quite unlike those found on land. It is only in the sea and at its margins that such strange and beautiful creatures as bristle worms, starfishes, sea cucumbers, and sea urchins are to be found. Octopuses, cuttlefish, corals, and sea anemones, too, live only in the sea or on its shores.

Tides and the Seashore

The greater part of the shore is periodically covered and uncovered by the tide. On British and European coasts, the tide comes in and out twice daily and it varies in range from day to day. Every fortnight, a few tides after the full and after the new moon, they have their greatest range and are spoken of as 'spring' tides. At these times the water at full tide rises higher up the beach and at low tide retreats farther down the beach than during the 'neap' tides which alternate with the springs. Twice yearly, at the equinoxes, extreme spring tides occur when a much greater area of beach comes under tidal influence. Although it is the moon's pull which chiefly controls the tides, other factors such as variations in barometric pressure, strong onshore winds, and storms at sea can also affect their height.



Little Cuttle (1–2″)

You will probably have noticed that the time as well as the range of the tide varies from day to day. Each day in any given place the time of high water is about 40 minutes later than on the preceding day. Local newsagents usually sell tide tables for their area. These are useful if you want to find out the exact time of any particular tide and the height to which it is expected to rise.

Food and Shelter

Seaweeds flourish on most shores except where shifting sand and pebbles occur or where the force of the waves is too great. The seaweeds, together with the microscopic algae in the sea, provide food for plant-eating animals which in their turn supply the needs of the flesh-eaters. Most animals need a great deal more oxygen than plants, but shore waters get very well aerated as they break up into waves and spray, and oxygen is also, during the day, given off by the seaweeds as a by-product of their food-making activities. The plants, therefore, in many cases, supply the animals with food, oxygen, and shelter.

The rich resources of the shore are the main reason why such *large numbers* of animals are found there. An important reason why so many *different kinds* occur is the great variety of habitats, or living-places, which the shore provides. There are the rocks, the pools, the cliffs, the crevices, the sandy beaches, and the muddy estuaries to mention but a few. Moreover, habitats near the bottom of the beach are covered by the tide for the greater part of the time whereas, in contrast, those near the top of the beach are left uncovered for long periods.

Where to Search and What You Need

It is wise to find out the state of the tide when you plan your expedition, and this can be done, as explained on page 2, by consulting local tide tables. Arrive at the beach about an hour before low water and follow the tide down. Try not to miss those days near the full and new moons because these are the times of the spring tides when a lot of beach is left uncovered, revealing many plants and animals which are not often exposed. Here delicate sponges and sea anemones encrust the damp rock surfaces and giant edible crabs may lurk in the crevices.

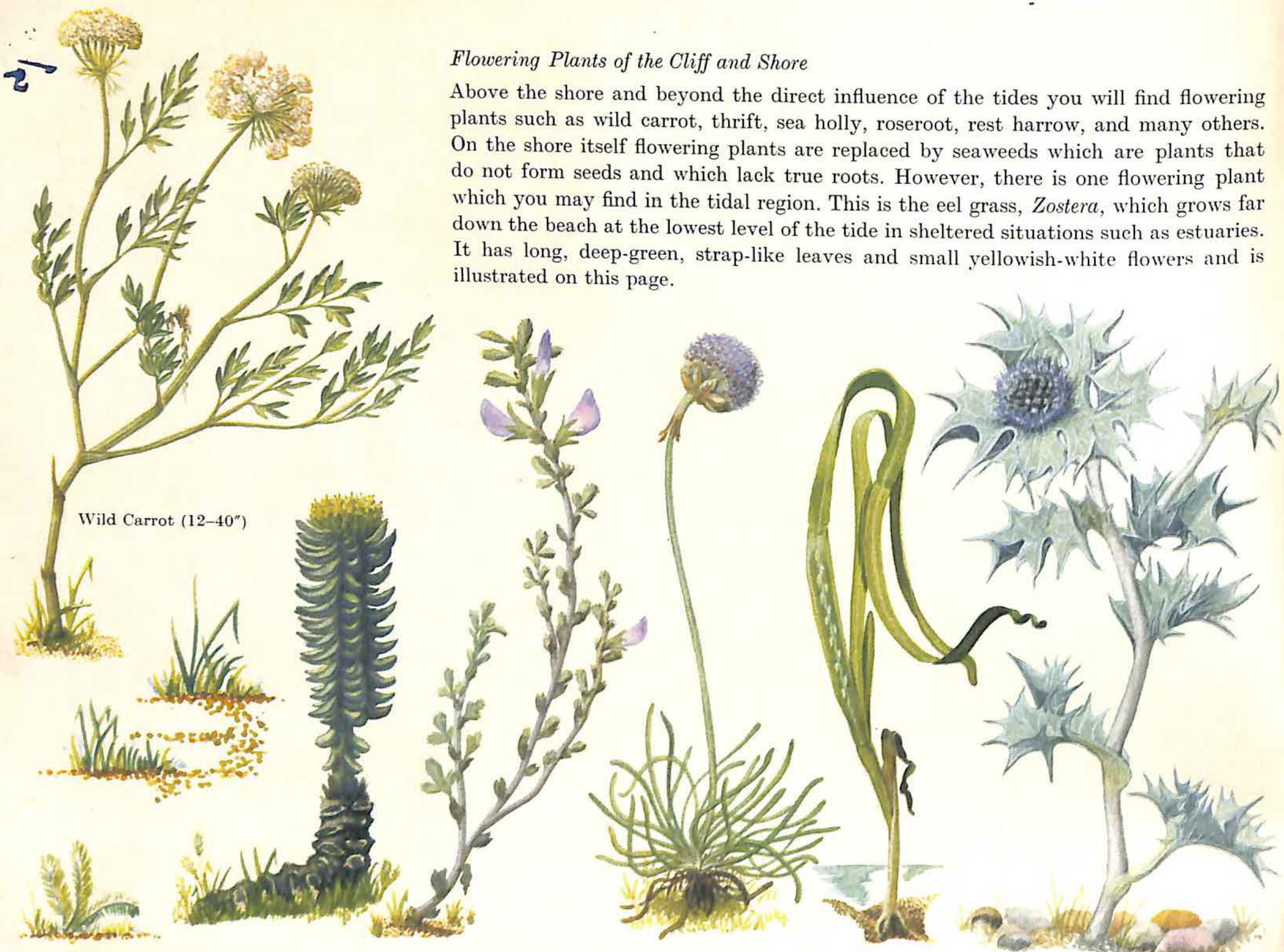
Do not burden yourself with too much collecting gear, especially if you have to clamber over a rocky beach. You will need a basket, or better still a plastic bucket, in which you can carry a hand net, one or two large tins with lids, some polythene bags, and a white enamel dish for examining the catch. A few small, corked plastic or glass tubes (which can be got from a chemist), a hand lens, a pair of forceps, a pocket knife, a pipette, and a water-colour brush for picking up delicate specimens are also useful. These are the basic needs. It is safer to use plastic rather than glass containers and, of course, do not use tins with sharp edges. If you are exploring pools it is interesting to have a glass-bottomed box so that you can see clearly beneath the water surface, and when collecting on sand or mud it is important to have a sieve and a garden fork in addition to the other gear. Always keep the prongs of the fork protected with a guard when you are not using it. The beach may be large but remember never to dig holes without filling them up again before you leave and never to turn over stones without replacing them after you have finished looking at the things underneath them. Remember too that although the vast majority of seaweeds and shore animals occur in great profusion there are some which are rare, or local, in their distribution, and the existence of these may be seriously threatened by wanton collectors.

207

Library

Flowering Plants of the Cliff and Shore

Above the shore and beyond the direct influence of the tides you will find flowering plants such as wild carrot, thrift, sea holly, roseroot, rest harrow, and many others. On the shore itself flowering plants are replaced by seaweeds which are plants that do not form seeds and which lack true roots. However, there is one flowering plant which you may find in the tidal region. This is the eel grass, *Zostera*, which grows far down the beach at the lowest level of the tide in sheltered situations such as estuaries. It has long, deep-green, strap-like leaves and small yellowish-white flowers and is illustrated on this page.



Wild Carrot (12–40″)

Roseroot (6–12″)

Rest Harrow (12–24″)

Thrift (1–6″)

Eel Grass (12–40″)

Sea Holly (12–24″)

31.8.05
11895

Seaweeds

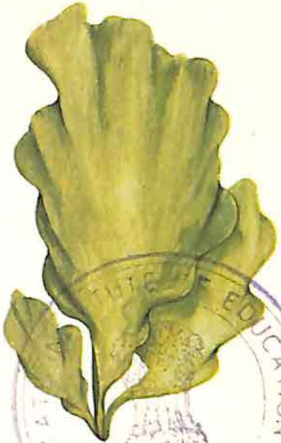
The true plants of the shore are seaweeds or marine algae and the botanist recognizes three main kinds, red, green, and brown ones. All possess chlorophyll, the green pigment which allows plants to make their own food, but in the brown and red weeds this is masked by other pigments. The so-called red weeds occur in all shades of pink and crimson and purple. Their form varies greatly, some are delicately branched and lace-like and of these *Ceramium*, illustrated here, can be recognized by the minute pincerlike tips to its branches whereas *Lomentaria*, also shown, is made up of soft, shining, beadlike sections, and the beautiful *Delessaria* has broad, thin fronds. Others, the calcarious red algae, are impregnated with lime and may be branched and jointed like *Corallina* or else form a purple, encrusting lining to the rock pools, as *Lithothamnion* does, looking like a splash of purple paint rather than a plant! Another interesting red weed is *Chondrus*. This shines with a blue iridescence when in the water which does not show when it is taken out. A widely distributed green weed is *Ulva*, the sea lettuce. Another to look for is *Enteromorpha*, whose bright, unbranched, green strands usually occur in pools high up on the shore. In dry summer months these often dry and leave a white, crisp carpet over the rocks near high-tide level. A larger green weed, also shown on this page, is *Codium*. This has dark-green, spongy, cylindrical branches and a beautiful growth form. Look for it growing in deep pools in the middle and lower shore.

Preserving Seaweeds

Small, delicate seaweeds can be mounted by floating them in a dish of fresh water and then transferring them on to a sheet of firm card. This can best be done with a fine brush, which should be used to arrange them on the card, and then by draining off the water and leaving the mounted specimens to dry. In this way they keep much of their natural beauty and can be preserved for years.

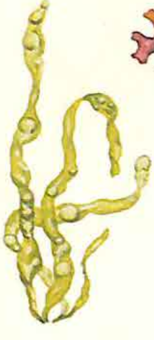
All life size except *Delessaria sanguinea*

2076
~~8450~~

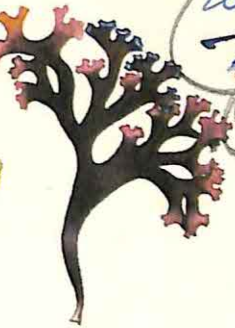


Ulva lactuca (Sea Lettuce)

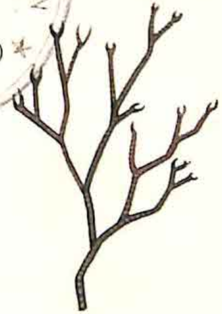
INSTITUTE OF EDUCATION BANPUR



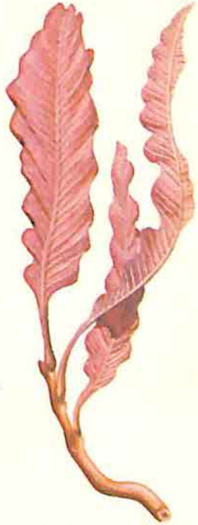
Enteromorpha intestinalis



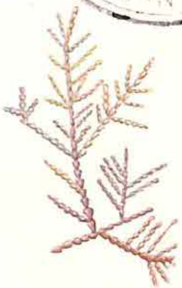
Chondrus crispus



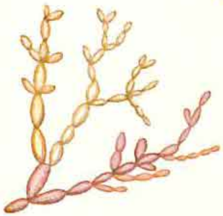
Ceramium rubrum



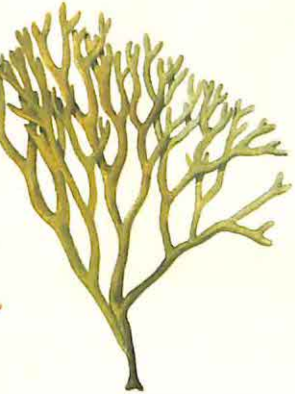
Delessaria sanguinea (10″)



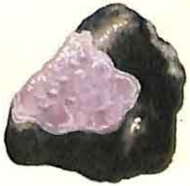
Corallina officinalis



Lomentaria articulata



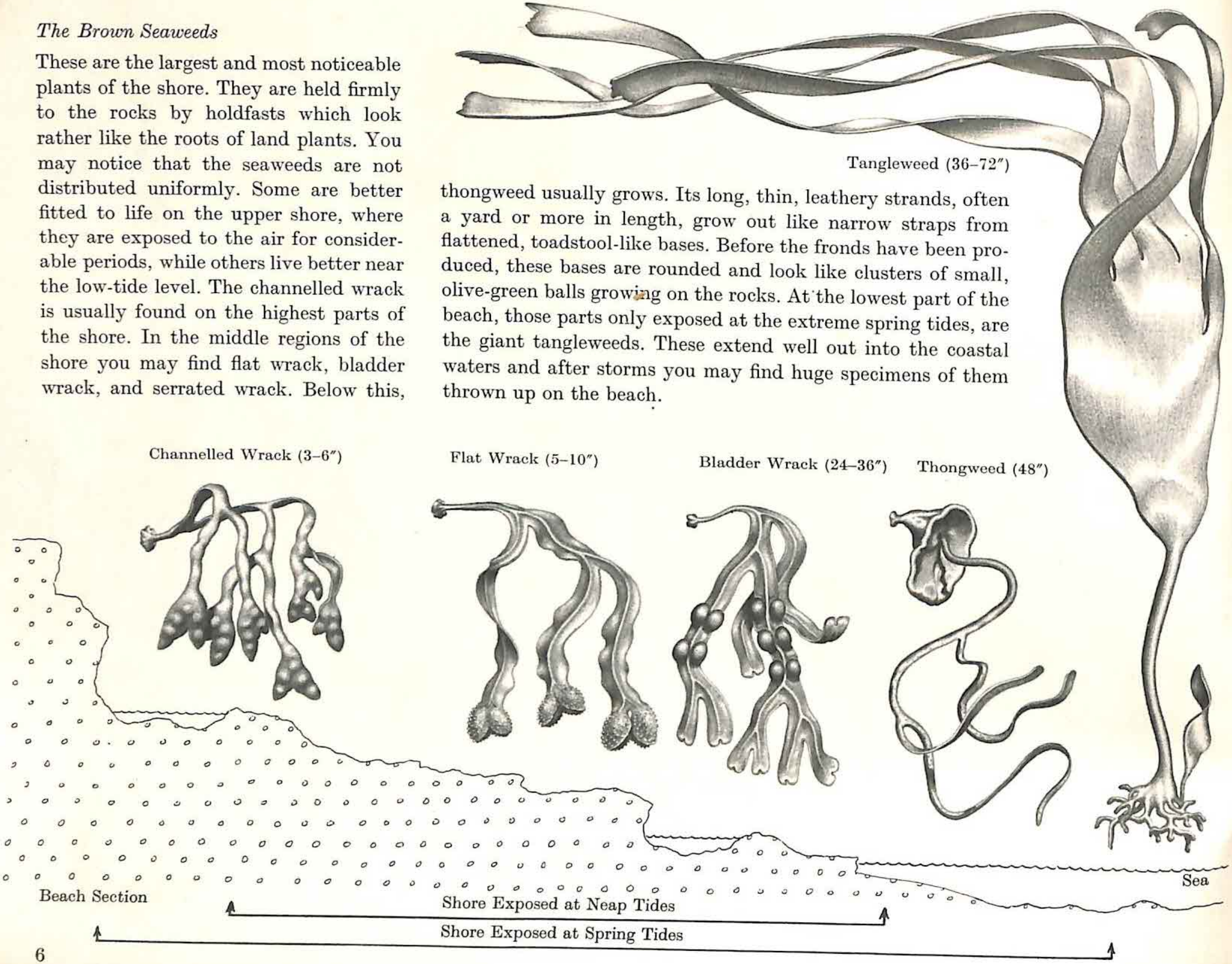
Codium tomentosum



Lithothamnion sp.

The Brown Seaweeds

These are the largest and most noticeable plants of the shore. They are held firmly to the rocks by holdfasts which look rather like the roots of land plants. You may notice that the seaweeds are not distributed uniformly. Some are better fitted to life on the upper shore, where they are exposed to the air for considerable periods, while others live better near the low-tide level. The channelled wrack is usually found on the highest parts of the shore. In the middle regions of the shore you may find flat wrack, bladder wrack, and serrated wrack. Below this, thongweed usually grows. Its long, thin, leathery strands, often a yard or more in length, grow out like narrow straps from flattened, toadstool-like bases. Before the fronds have been produced, these bases are rounded and look like clusters of small, olive-green balls growing on the rocks. At the lowest part of the beach, those parts only exposed at the extreme spring tides, are the giant tangleweeds. These extend well out into the coastal waters and after storms you may find huge specimens of them thrown up on the beach.



Tangleweed (36–72″)

Channelled Wrack (3–6″)

Flat Wrack (5–10″)

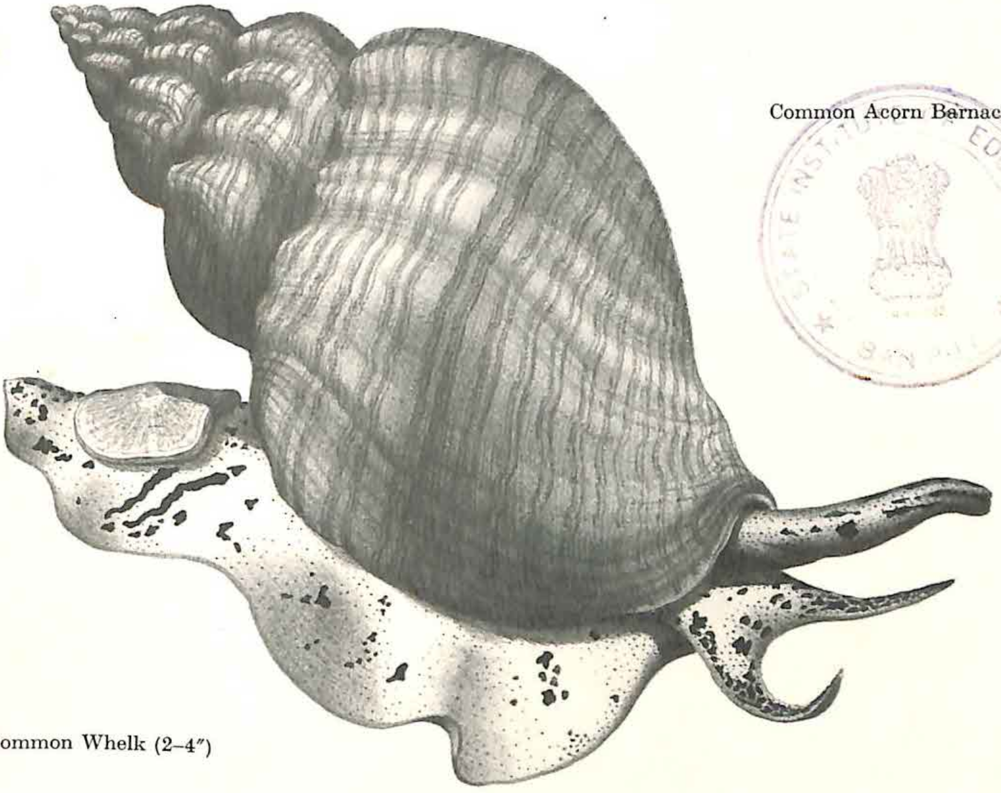
Bladder Wrack (24–36″)

Thongweed (48″)

Beach Section
Shore Exposed at Neap Tides
Shore Exposed at Spring Tides
Sea

Animals of the Rocky Shore

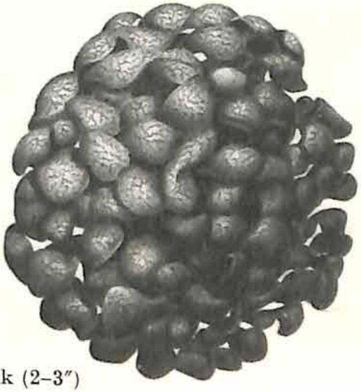
One of the greatest problems that shore animals have to combat is the risk of drying up when the tide is out. There are two main ways in which this problem is overcome. Some animals have a shell or a skin which resists drying up and which can *withstand* periods of drought lasting six hours or longer and which enable them to stand up to the force of the waves as they break. Others are more delicate in structure and *avoid* exposed conditions by sheltering in rock pools, crevices, under stones, or by burying themselves. These *avoiders* occupy sheltered places and so require a more careful search than do the *withstanders*. Many shore animals can breathe oxygen from the air when the tide recedes. Remember too that all shore animals, especially those which live in pools, need to be able to survive sudden changes in the salinity, temperature, and acidity of their surroundings. Animals which live in the open sea where conditions are more constant, do not need these special powers.



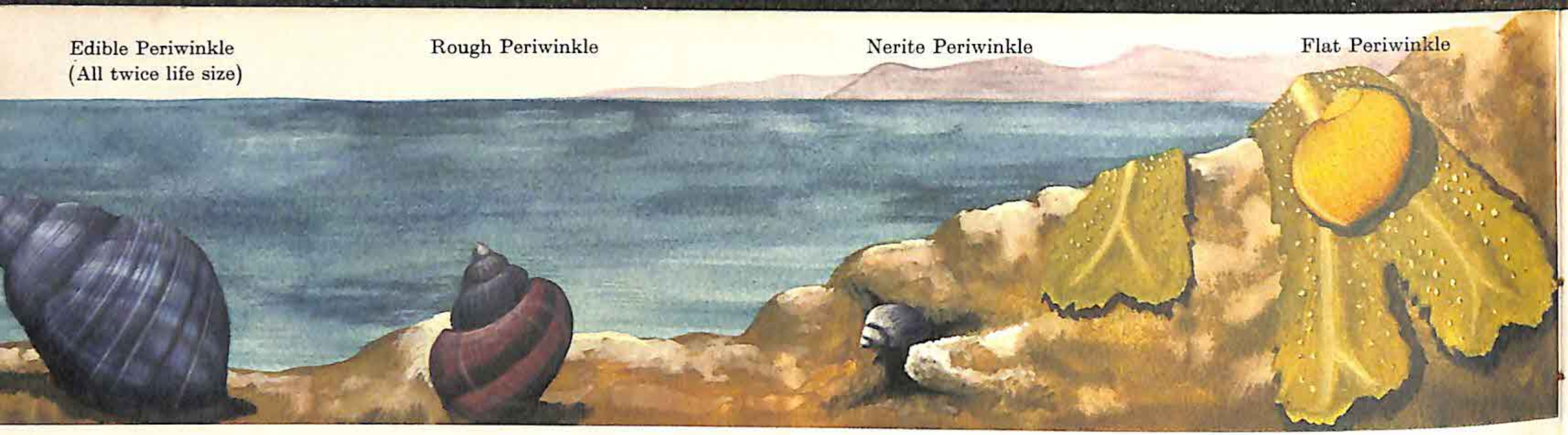
Common Whelk (2–4″)

Common Acorn Barnacle Feeding (¼″)

STATE INSTITUTE OF EDUCATION



Egg-Case Cluster of Common Whelk (2–3″)



Looking for Molluscs on a Rocky Shore

Molluscs are very well fitted for shore life. Most of them have protective shells and many collectors hunt only for these. It is more interesting, however, to search for the complete animals and to find out how each moves and feeds and breathes and to inquire into their different habits. Although all are placed in the same animal group (or phylum), molluscs show striking differences in their outward appearance and in their way of life. Three classes of molluscs, the GASTROPODS, the BIVALVES, and the CHITONS are common intertidal forms. The members of the other two molluscan classes, the strange little elephant-tusk shells (which are SCAPHOPODS) and the octopuses and cuttlefish (the CEPHALOPODS) normally inhabit the region below tide level.

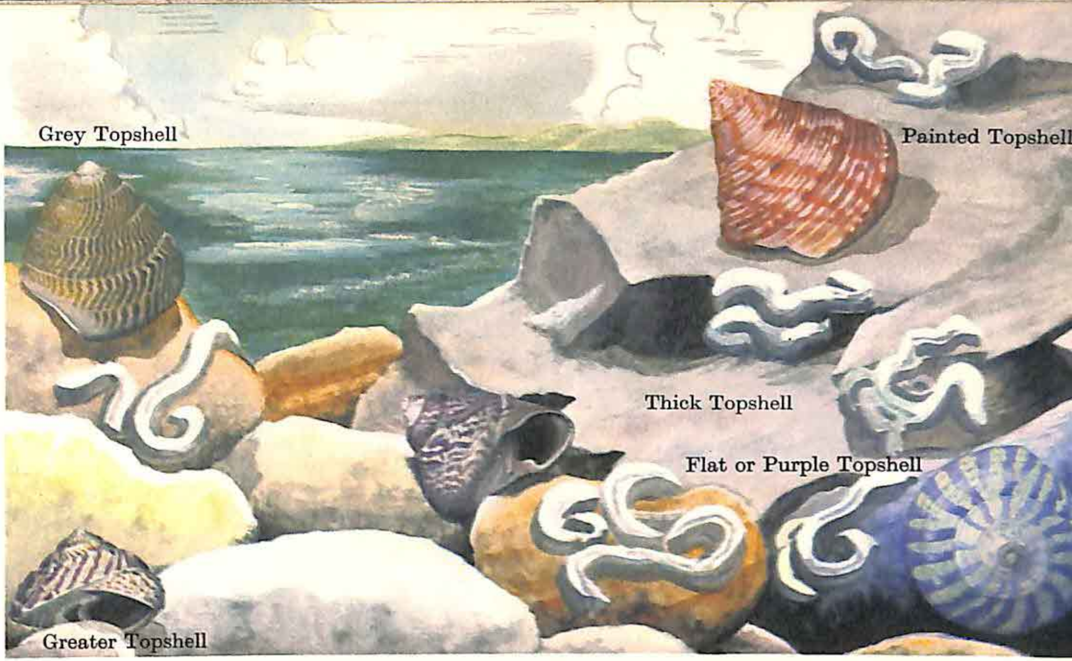
Some of the gastropods (that is, the slug- and snail-like molluscs) are described on the following two pages. You may notice that those with strong, protective shells tend to live in exposed places, whereas those that are thin-shelled or naked tend to live in pools and crevices and near the low-tide level. The oyster drill and some other gastropods are flesh-eaters, but most are herbivorous and graze on the seaweeds. The periwinkles shown above are found on almost every rocky beach. The smallest of them, the nerite periwinkles, usually live in rock crevices or in empty barnacle shells, high up on the beach where they are only reached by the highest tides and on shores where there is much wave action. They have sharply pointed shells which have, when wet, the colour and appearance of well-polished wood. A little farther down the beach and also on the bare rock surface you may find rough periwinkles. These have brown-, grey-, or tan-coloured shells, some varieties of which are strongly ribbed. They can be distinguished from nerite periwinkles by the fact that their eyes are not in the middle of the tentacle base but at its side as well as by shell characters. The third species to look for are flat winkles. These have beautiful thick, smooth, rounded shells (quantities of empty ones are often washed up on shingle beaches). They may be bright yellow, lemon, orange, brown, olive green, or black. Look for living specimens among the serrated wrack for they feed on this seaweed and shelter in its damp fronds when the tide is down. Edible periwinkles are very widely distributed. They often occur in hundreds in pools, on bare rock, on shingle, or on mud. Their pointed shells are usually black or dark grey and are smooth except when young. They are the largest of the periwinkles and may grow to well over an inch in height.

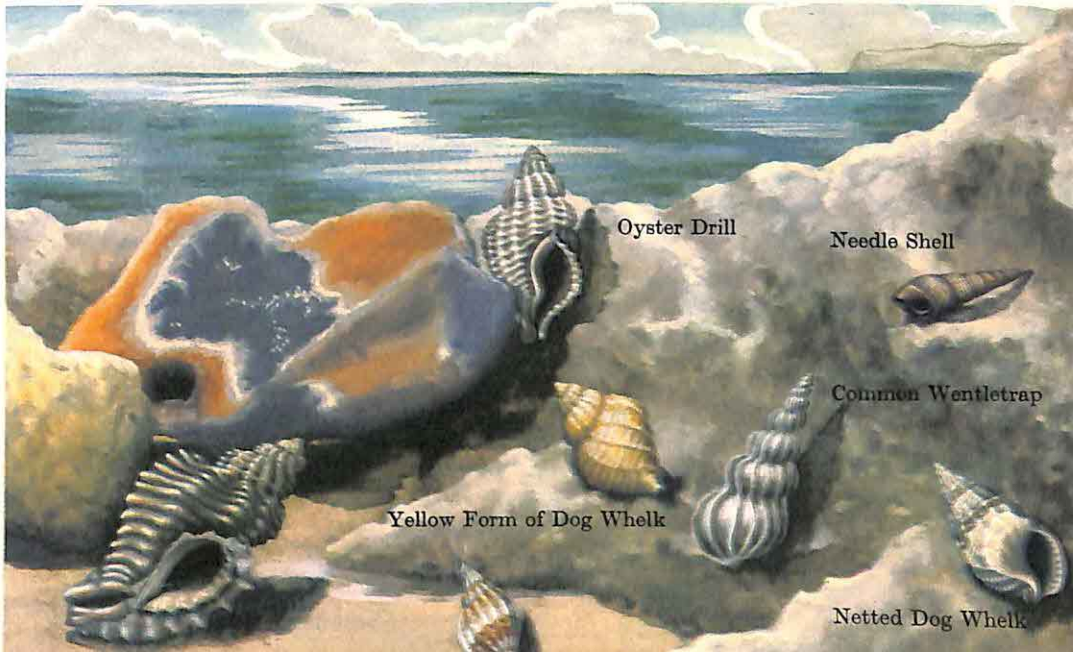
Topshells

While you are looking for periwinkles you may find topshells, which are very similar to them in appearance. Several species are illustrated here including the beautiful painted topshell.

Whelks, Wentletraps, and Needleshells

These are all snails with tall, turret-shaped shells. The whelks have a long proboscis which some use for boring through shells of other shore animals and sucking out the contents. A long siphon, used for breathing, projects along a groove in the shell. The dog whelk is illustrated here. It has a thick shell, up to an inch in height, which is usually white but may be banded with brown or blue. It lives among barnacles and mussels which form its food. The sting winkles and oyster drills are similar but have rougher, more angular shells. The latter are found in the south-east of England, where they have been accidentally introduced from America. Both the netted dog whelk and the thick-lipped dog whelk are scavengers. In both these molluscs the foot, when extended, appears deeply notched at the back. The common wentletrap has a beautiful ridged shell and is occasionally found near low-tide level. Here also you may find the small, pointed, delicately sculptured needleshells. These are reddish-brown in colour and are found among decaying seaweed.





Cowries

The shells of both the European cowrie (which has three dark spots on it) and of the Arctic cowrie are well known to most people, but search for the living animals as they feed on sea squirts under damp rock surfaces near low-tide level and notice that the shell is completely hidden by the brightly spotted, soft mantle tissues which extend over it.

Limpets

The common limpet has a strong, conical shell and a broad foot which secures it to the rocks. It can withstand exposure to the waves very well and it is found on most rocky shores. The prettiest of all the limpets is probably the delicate blue-rayed limpet. This has a shell which may be no bigger nor thicker than your little fingernail: it is olive green in colour and streaked with vivid, kingfisher-blue lines that shine with a bright, metallic lustre. The living limpets graze on the great tangleweeds at low-tide level. When young they feed on the fronds, but later they migrate down the stems to the holdfasts and as they grow older the shells thicken and grow darker. Other species to be looked for are the tortoiseshell limpet and the keyhole limpet. The latter occurs low down the shore: it has a rough shell which exposes the mantle of flesh below it and there is a small slit at the apex. It is a relative of the beautiful ormer, which has a row of holes penetrating its large, pearly shell. The ormer is found on southern European coasts but nowhere in Britain except in the Channel Islands. A newcomer to Europe from America is the slipper limpet. This usually lives below tide level but its empty shells are very common on many beaches in southern England and South Wales.

Sea Slugs

These beautiful gastropods have no external shell. They are often brilliantly coloured and their full beauty can only be seen by watching living specimens. Two of them, the sea lemon and the sea hare, are illustrated on the opposite page. Some feed on hydroids (see p. 16) and, in a way which is not fully understood, keep the stinging cells from the hydroid for use in their own defence.

Common Limpet

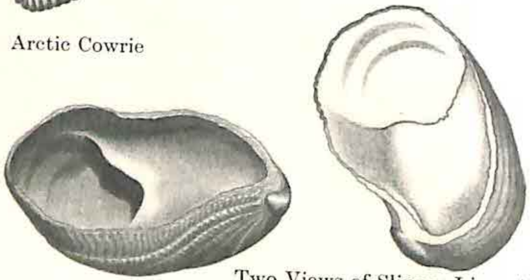
Tortoiseshell Limpet

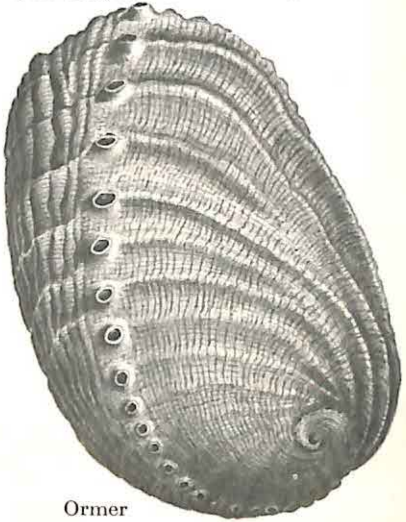
Keyhole Limpet

Blue-Rayed Limpet

European Cowrie

Arctic Cowrie


Two Views of Slipper Limpet

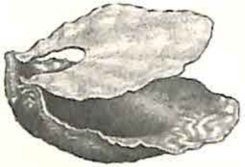

Ormer

Bivalves

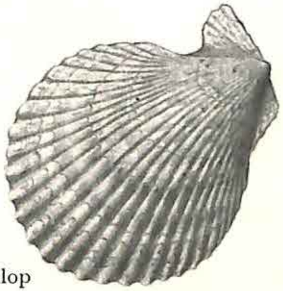
These are molluscs which, like mussels, have two shells. Many live in sand and mud but some, such as the mussel itself, are suited to life on rocky coasts. The slate-blue mussels are prevented from being washed away by hairlike 'beards' which fix them to the rocks. Others, like the piddock, bore into rocks and shelter in the holes they make for themselves. The attractive hunchbacked scallops cement themselves to the rocks, whereas the delicate, pearly-shelled saddle-oysters have a hole in one of their shells through which the foot and threads of a chalky 'beard' grow and anchor them firmly on to the rock. These are some examples of molluscs which manage to survive on rocky, wave-washed shores.

Chitons

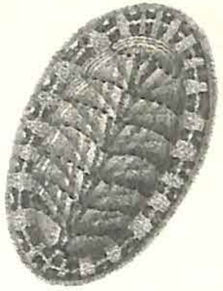
These are known as coat-of-mail shells. They are common in pools and under stones wherever the shore is permanently damp. At first they may seem like a species of limpet, but if you look carefully you will see that their shell is made up of eight overlapping plates. The two most common intertidal species, the smooth and the hairy chitons, are shown here. The shell of the smooth chiton shows a great variety of colour and pattern. When it feeds on coralline seaweeds it is often pink or purple, but grey, green, black, orange, and marbled forms occur.



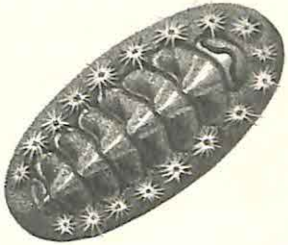
Saddle Oyster



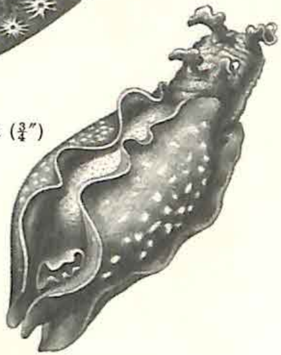
Hunchback Scallop



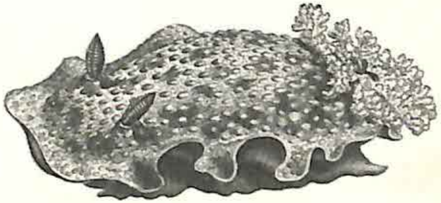
Smooth Chiton (½″)



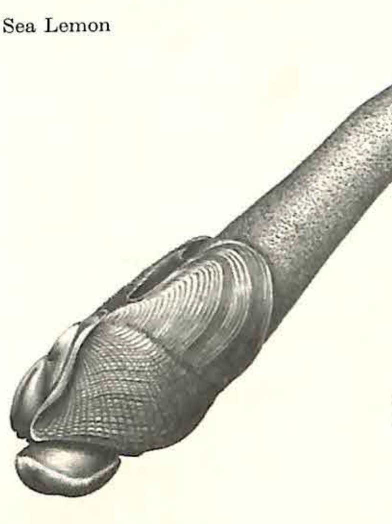
Hairy Chiton (¾″)



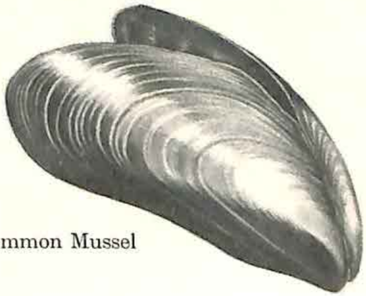
Sea Hare



Sea Lemon



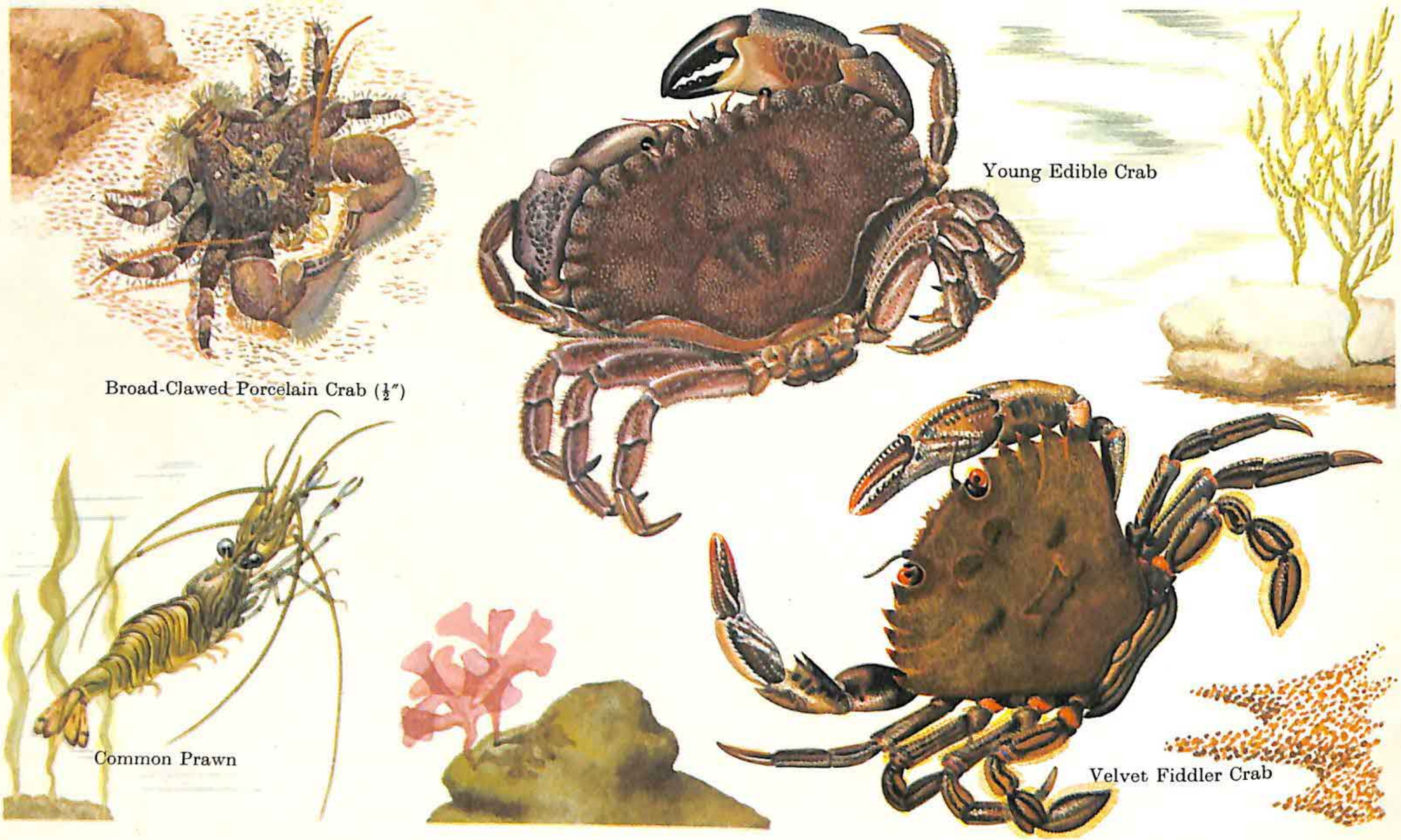
Oval Piddock



Common Mussel

Crustaceans of the Rocky Shore

Crustaceans form an interesting and important group of shore animals and you are certain to find some of them. They are ARTHROPODS, that is animals with jointed limbs such as crabs, lobsters, shrimps, sandhoppers, sea slaters, and barnacles. A few of these are described here for you to identify, but in addition there are countless smaller crustaceans, many microscopic in size, which live in the surface layers of the sea, in tidal pools, and in the film of water which fills each crack and crevice in the rocks and between the stones and sand grains in the moist parts of the shore.

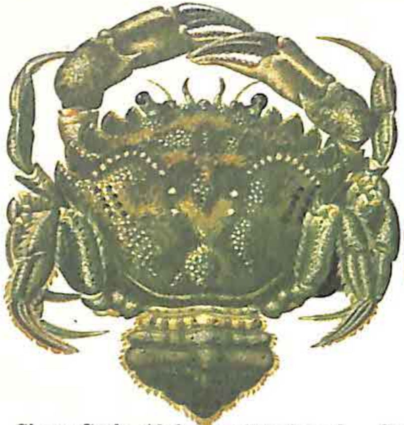


Broad-Clawed Porcelain Crab (½″)

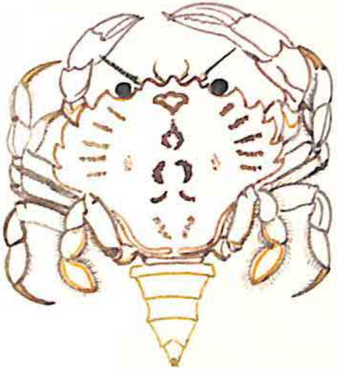
Young Edible Crab

Common Prawn

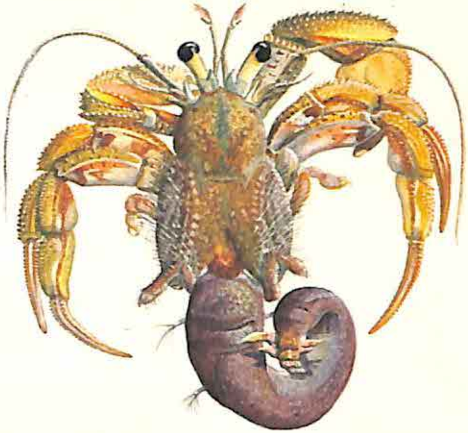
Velvet Fiddler Crab



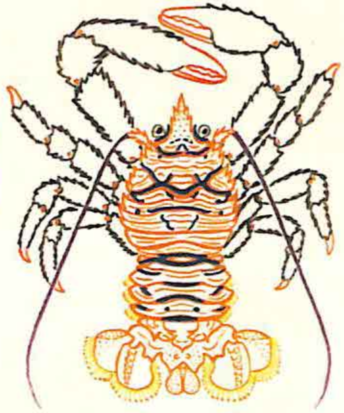
Shore Crab, Abdomen Displayed



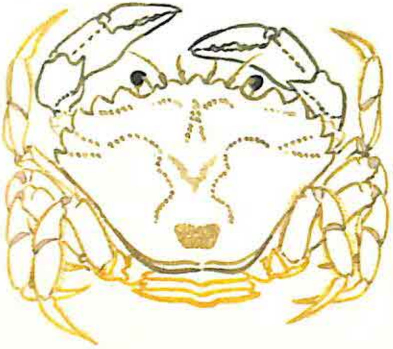
Swimming Crab, Abdomen Displayed



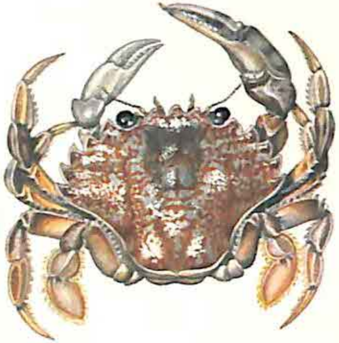
Hermit Crab, Removed from Shell



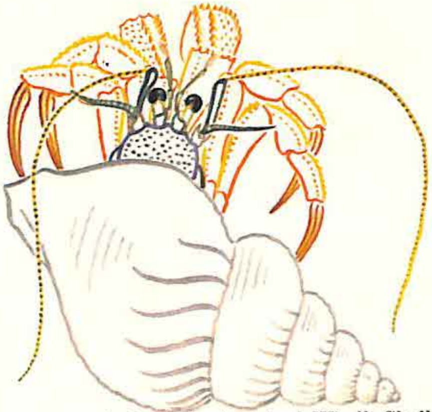
Scarlet Squat Lobster, Abdomen Displayed



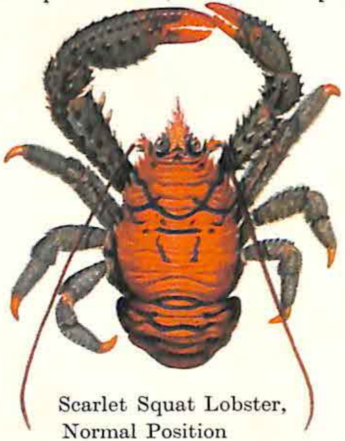
Shore Crab, Normal Position



Swimming Crab, Normal Position



Hermit Crab, in Acquired Whelk Shell



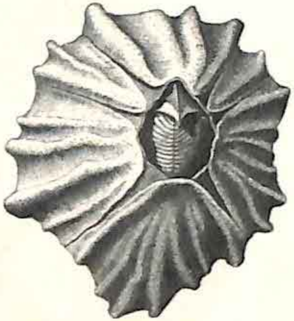
Scarlet Squat Lobster, Normal Position

Crabs, Lobsters, and Prawns

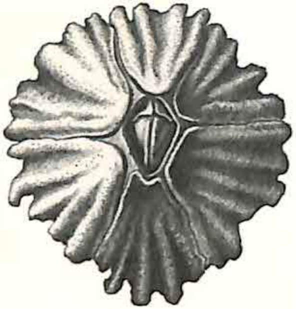
These are known as DECAPODS as they have five pairs of conspicuous limbs. In crabs and lobsters the first pair carry nippers. Crabs have the head and front part of the body encased in a hard carapace and the 'tail' or abdomen is tucked forward under this. In shrimps and lobsters the abdomen is easy to see and ends in a tail fan. The squat lobsters, hermit crabs, and porcelain crabs form an intermediate group and in all of these the fifth pair of limbs is much smaller than the other four pairs. In the hermit crabs the abdomen is long and soft, but in the other two groups it is flexed forward under the body and it ends in a well-formed tail fan – another feature which, with the weakly developed fifth pair of legs, distinguishes them from the true crabs.

Sometimes you may come across a soft-shelled crab. This is one which has recently cast its shell and in which the new outer covering has not yet hardened. Decapods, like other Arthropods, are forced to moult periodically because the hard outer skeleton cannot stretch once it has formed. The old shell is cast, revealing a new covering beneath, but this is at first soft and able to stretch and allow for growth. While moulting and until the new covering has hardened, the animals are very vulnerable and usually keep out of the way of other shore creatures by hiding in rock crevices.

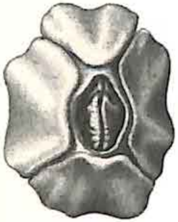
Acorn Barnacles



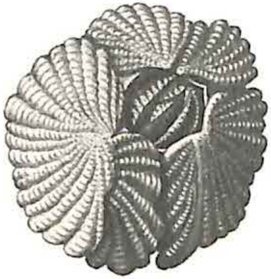
Balanus balanoides (¼″)



Chthamalus stellatus (¼″)



Elminius modestus (⅛″)

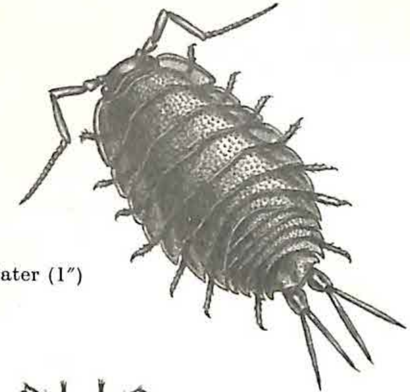


Verruca stroemia (⅕″)

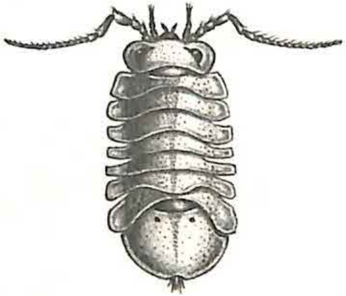
Barnacles

Barnacles are very well suited to life on a rocky shore and often occur in vast numbers. Indeed, possibly all you will have noticed about them, up to now, is the way they graze your feet as you clamber over the rocks. They are, however, most interesting animals, so try to dislodge a piece of stone that has some of them attached and place it in a bowl of sea-water. While they are closed they will probably remind you of molluscs, but if you watch them patiently you will see small 'trap-doors' open at the tip of each barnacle and tiny, jointed, feathery limbs will push out and comb the water repeatedly. When the sea retreats they close up and cease feeding until the tide rises and covers them again. These strange crustaceans start life as minute swimming creatures but later fix themselves, head downwards, to the rocks, form a shell, and use their limbs to catch their food

Four kinds of acorn barnacle are shown above. *Balanus*, of which several species occur, has its six shell plates separated apically by a diamond-shaped opening, whereas *Chthamalus*, a barnacle found on the upper shore of west and south-west coasts, is similar but the opening at the top is kite-shaped. A third barnacle, *Elminius*, has only four shell plates and these are usually smooth and glistening white. It recently invaded Europe from Australia and is spreading rapidly. *Verruca*, often common near low water, also has four shell plates: these are strongly ridged and this barnacle is not symmetrical but leans strongly to one side.



Sea Slater (1″)

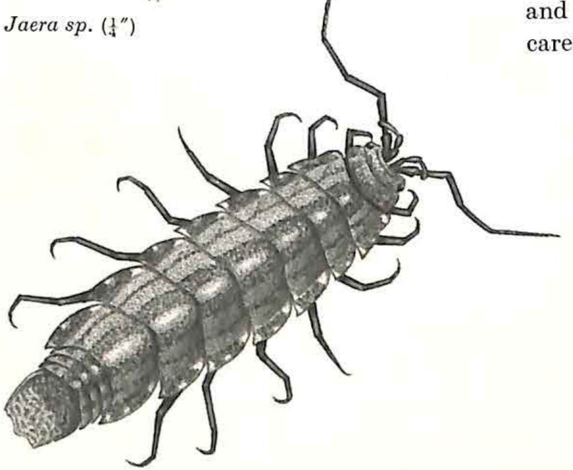


Jaera sp. (¼″)

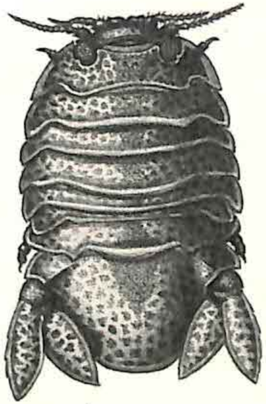
Slaters and Sandhoppers

Near the highest levels of most beaches you will find sea slaters. These are like large woodlice and they may reach an inch or more in length. At dusk, you may see them scuttling across the rocks but by day look for them at the top of the shore by dislodging small stones, probing in cracks, and looking among the roots of cliff plants. Also look for sandhoppers on this part of the beach. These shelter in seaweed and driftwood near the strandline. A species often found here is *Orchestia*, which is shown on this page. It is greenish brown in colour, flattened from side to side, and crescent shaped.

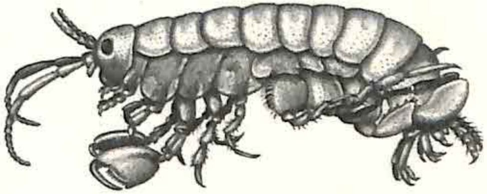
As you move down the beach, you will find other crustaceans. Look under stones, explore pools with your hand net, and collect seaweed and shake it out carefully in a dish of water. You will perhaps collect other relatives of the sea slater such as *Jaera*, *Idotea*, and *Sphaeroma*, which are illustrated here. All these are ISOPODS and are flattened horizontally. *Sphaeroma* can roll into a tight ball when disturbed by the oncoming tide or when handled. Also look out for other relations of the sandhopper. These are crustaceans which are in many ways similar to Isopods but which are typically flattened from side to side. They are known as AMPHIPODS. Among the most fascinating of these, which you may find if you are sharp-eyed, are small skeleton shrimps. These have a grotesque shape and look like a cross between a looper caterpillar and an animated piece of cotton! These are most easily noticed as they move across a piece of seaweed or when they drop off as the seaweed is gently shaken into a dish of sea water.



Idotea sp. (¾″)



Sphaeroma sp. (½″)



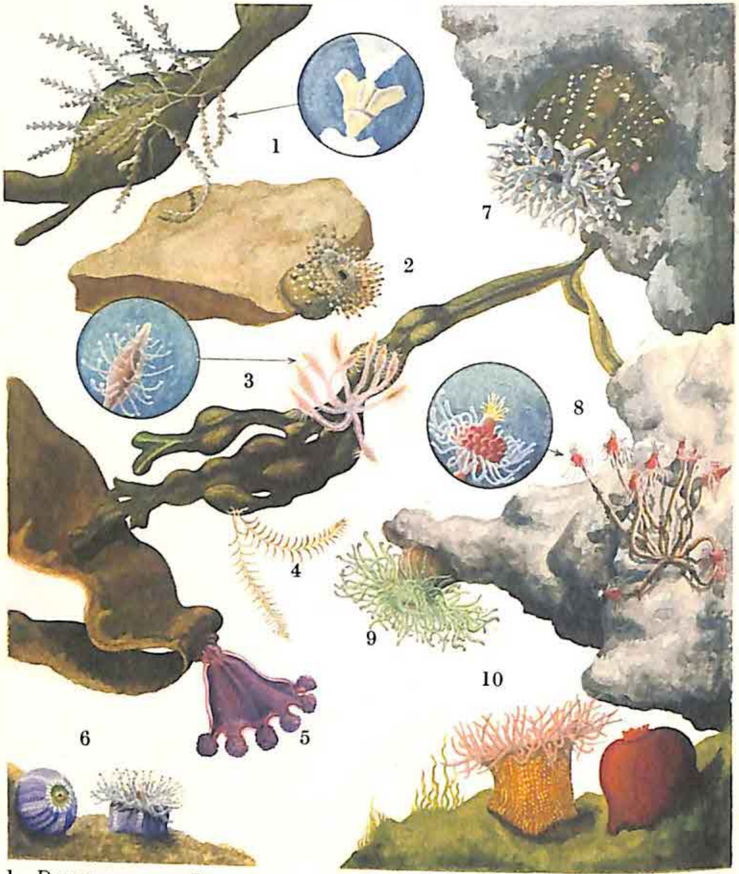
Sand Hopper (¾″)

Other Animals of the Rocky Shore

There are a great many inhabitants of the rocks and weed which have not yet been mentioned. These are chiefly found in sheltered situations and many of them are to be found only when the tide is at its lowest. Among them are many which are very unlike the animals with which you are familiar on land. Some, indeed, are not easy to distinguish by means of their appearance from plants. However, these apparently plant-like members of the Animal Kingdom catch and digest their food in essentially the same way as the more typical animals, but many of them are fixed to one place and have a spreading, or branching, form of growth like that of plants. Such animals either draw their food towards themselves by means of water currents or catch it by means of tentacles and they look quite different from animals which move about in search of their food.

Hydroids and Sea Anemones

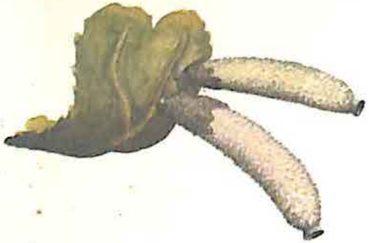
These and their relatives, the corals, catch their food with tentacles. Four hydroids are shown on this page. These are small and grow in colonies enclosed in a delicate, protective covering. They are usually found growing on the fronds of wracks and tangleweeds. The sea anemones are larger and more conspicuous. A few that you may find are shown here. The beadlet anemone expands its tentacles when the water covers it, but when the tide is down it looks like a soft, red blob on the rocks. A variety of beadlet is spotted with green and known as the strawberry anemone. Another illustrated here is the snakelocks anemone which has long, smooth tentacles which cannot be fully retracted.



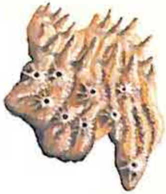
1. *Dynamena pumila*
2. *Sagartia sp.*
3. *Clava squamata*
4. *Kirchenpaueria pinnata*
5. *Lucernariopsis*, a stalked Jellyfish
6. Wartlet Anemone
7. Dahlia Anemone
8. *Tubularia indivisa*
9. Snakelocks Anemone
10. Beadlet Anemone

Sponges, Sea Mats, and Tunicates

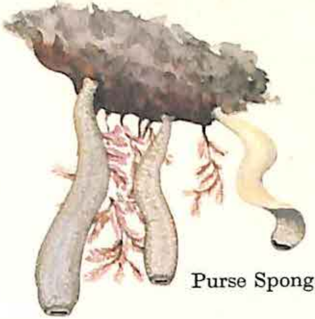
Some of these are illustrated on the opposite page. Most are to be found at and below the low-tide level. Many of the sponges are brilliantly coloured and they continually draw water through their bodies and extract food from it. Most have skeletons made up of fine spicules but it is the horny skeleton of a deep-water form that is sometimes used as a bathroom sponge. Those illustrated here, the purse sponge, the crowned sponge, the acrid-smelling *Hymeniacidon*, and the breadcrumb sponge



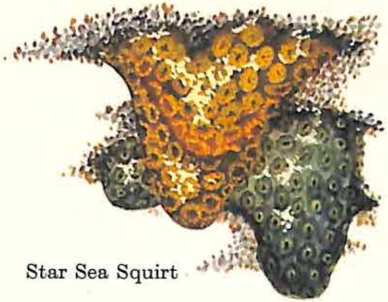
Crowned Sponge



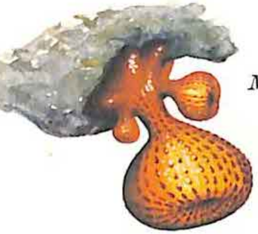
Hymeniacidon perleve



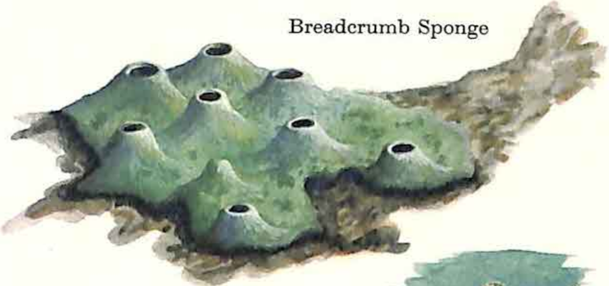
Purse Sponge



Star Sea Squirt

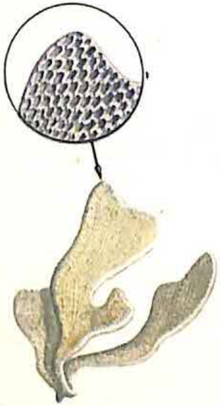


Morchellium argus

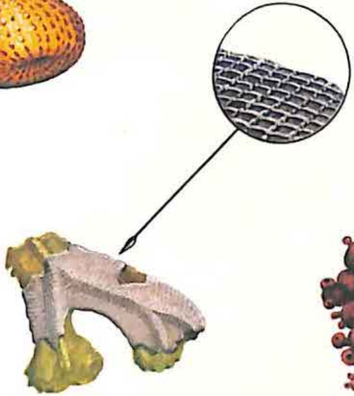


Breadcrumb Sponge

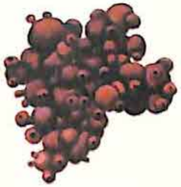
Sea Mats



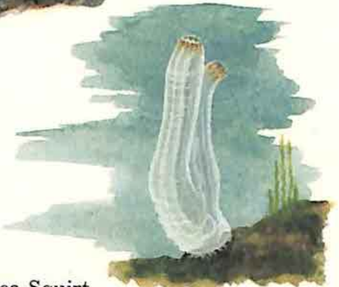
Hornwrack



Membranipora



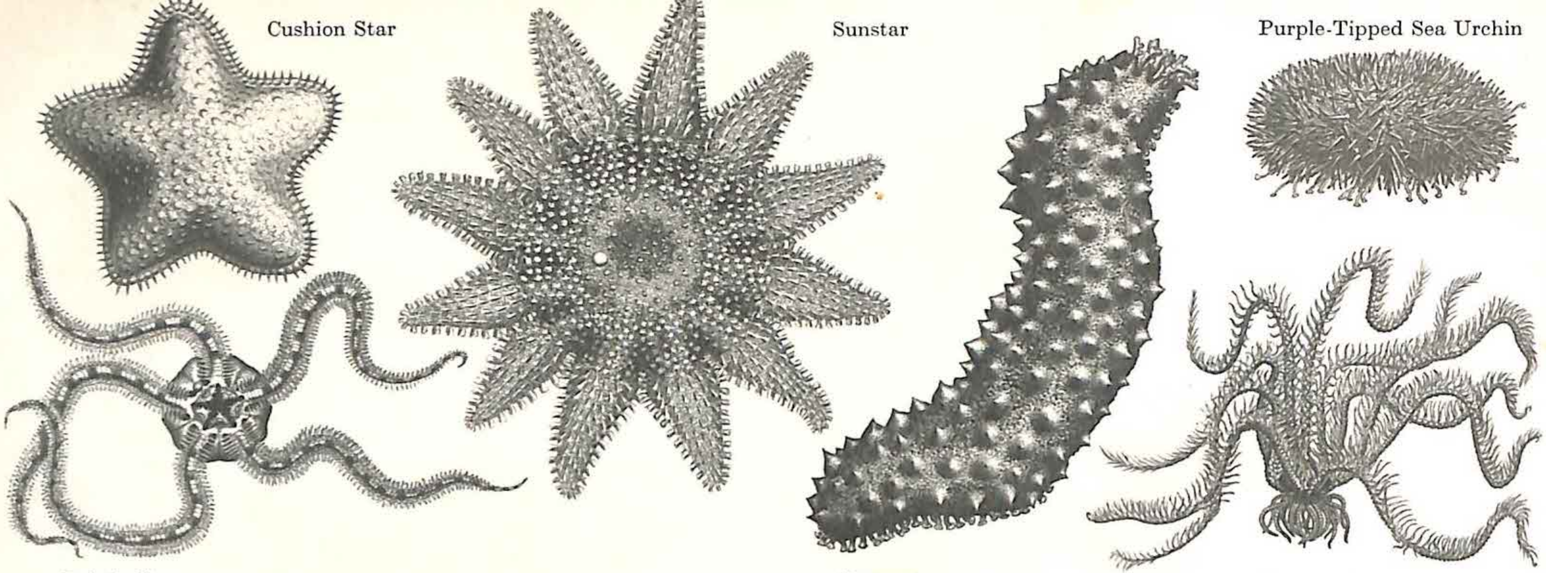
Gooseberry Sea Squirt



Sea Squirt

(which spreads over the rocks like a mass of miniature green volcanoes) are all fairly frequent in the shelter of overhanging rocks.

The strange sea squirts, though very different from sponges in structure and evolutionary position, are somewhat similar to them in habit. They may be solitary (as *Ciona*), in groups (as in the gooseberry sea squirt), or closely associated (as in *Morchellium* and the beautiful star sea squirts). In these last, the brightly coloured individuals (they may be scarlet, yellow, blue, or violet) are arranged like the petals of a flower within a thin gelatinous film on the rocks. Also shown here are two 'sea mats'. *Membranipora* usually forms encrusting patches on seaweeds whereas the hornwrack forms stiff, flat, leaf-like colonies.



Cushion Star

Sunstar

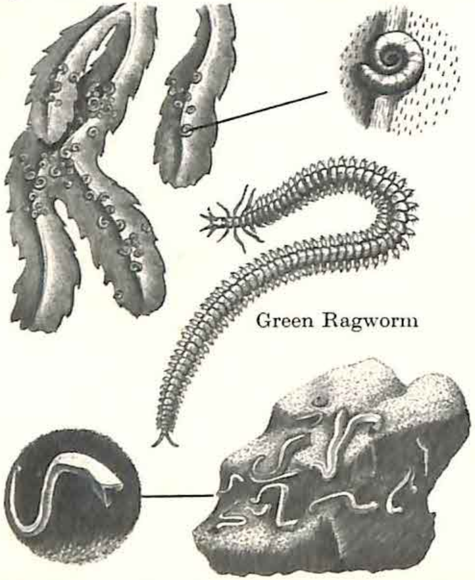
Purple-Tipped Sea Urchin

Brittle Star

Cotton Spinner

Feather Star

Spirorbis borealis



Green Ragworm

Pomatoceros triqueter

Starfishes and Their Kind

These animals, the ECHINODERMS, are all marine. The phylum has five classes, all of which have rocky-shore representatives. Those illustrated here are the cushion star and the sunstar, both of which are starfishes; the brittle star *Ophiothrix*, which moves by means of its sinuous, spiny arms, and the purple-tipped sea urchin, which is fairly common under stones in rock pools. The remaining two classes are the sea cucumbers and the sea lilies. The cotton spinner is an example of the former class and the beautiful feather star is a sea lily. These two species are found only in the south-west.

Annelids of the Rocky Shore

These are worms whose bodies are built up of a large number of divisions known as segments. You may find the bright green worm *Eulalia* moving over the damp surface of exposed rocks but most of the shore worms shelter in rock crevices or have tubes of sandy particles or protective chalky coverings. The coiled white tubes of *Spirorbis*, shown in the illustration, are often found in large numbers on the fronds of *Fucus* and the larger white tubes of *Pomatoceros*, also shown, can usually be found attached to boulders or encrusting the shells of molluscs or crabs.

Fish of the Rocky Shore

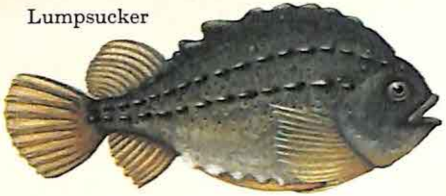
There are many fish whose true home is the shore and which take shelter in rock pools or even out of water beneath stones or in damp seaweed between tides. Some of these rely on their moist skin, rather than on their gills, for a breathing surface. Such fish, if kept in a small jar of water, quickly suffocate, but will keep in good condition for a long time if kept out of water in a cool jar of damp seaweed. This may prove a useful hint if you wish to take shore fish home to stock your aquarium.

Some rocky-shore fish are able to hold themselves firmly to the rocks by means of a sucker formed from fins on their ventral surface. This prevents them from being washed out to sea or dashed against the rocks in all but the wildest winter storms. Three fish able to anchor themselves in this way are shown at the top of the following page – the lumpsucker, the 'sea snail', and the Cornish sucker-fish. This last is a small fish with a flattened, triangular head that bears a pair of vivid, eye-like markings which are quite harmless but which appear very menacing. When you find one it will probably not attempt to swim away but will remain motionless. This stillness and its colouring make it very difficult to distinguish from the surrounding rocks.

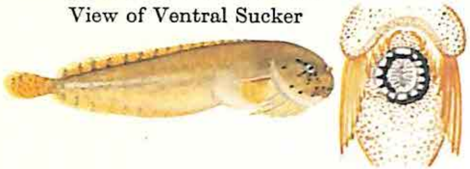
On any rocky beach you will almost certainly find the common blenny. This feeds on barnacles and has strong teeth which can give quite a powerful bite. The three-spined stickleback occurs in brackish pools near high water, but the handsome fifteen-spined stickleback is a true inhabitant of the intertidal area. Other common shore forms, illustrated on the next page, are the vividly coloured wrasse, the sea scorpion, the rocklings, and the quaint pipefish. These last have stiff, olive-green bodies and are easily mistaken for stalks of seaweed. In pipefish, as in their relatives the sea-horses, the male has a pouch into which he collects the eggs and in which he protects them until they hatch.

Fish of Estuaries and Sandy Beaches

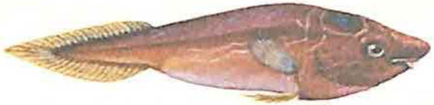
These fish are mostly very well camouflaged and are difficult to see against their sandy background, but if you paddle through shallow water near low-tide level you may notice small flatfish darting out from beneath your feet. Several species of these fish are to be found here. They all spend their larval life floating in the plankton out at sea and then, when they are only a couple of inches long, migrate inshore to the shallows. Here they spend much of their time buried just below the surface of the sand and you will notice them if your footsteps or your shrimping net disturb them. As these fish mature they leave the tidal area and return to the deeper water. Three species, the plaice, the flounder, and the dab, are illustrated on the next page, but others such as the topknot, the turbot, the sole, and the brill are also to be found inshore when they are young. If you walk barefooted, you may be unlucky enough to experience a violent, throbbing pain as you tread on the poison spines of a weaver fish concealed in the sand. Some fish swim about energetically in shoals in the shallow water that lies over the poorly drained sand flats. Others, like the sand eels, bury themselves below the surface. A fish which is very widely distributed, provided that there are a few stones to give it shelter, is the butterfish or gunnel. This is ribbon-shaped and bears attractive dark markings along its back. It is found on both rocky and sandy shores and in early spring it may be found coiled around its cluster of yellow eggs. The duty of guarding these eggs is carried out by both the male and the female in turn.



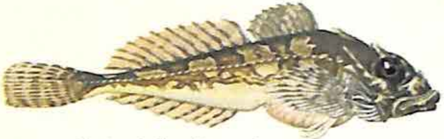
Lumpsucker



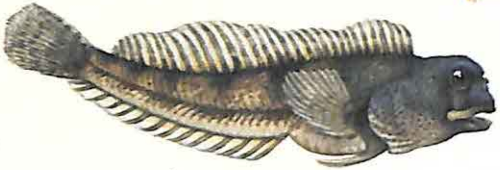
Montagu's Sea Snail, and View of Ventral Sucker



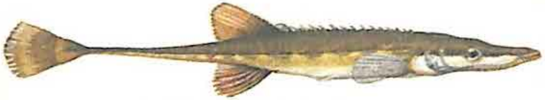
Cornish Sucker-Fish



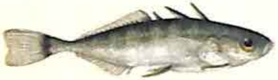
Long-Spined Sea Scorpion



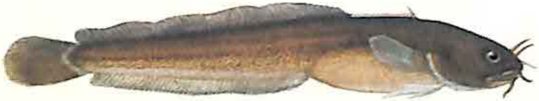
Common Blenny



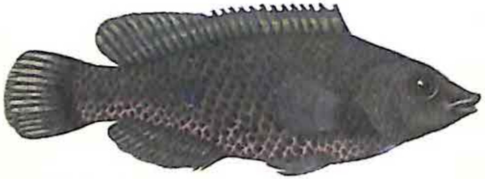
15-Spined Stickleback



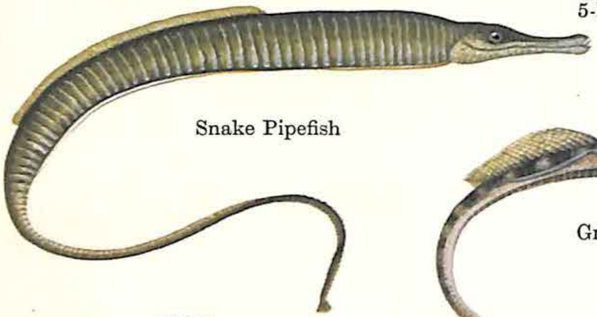
3-Spined Stickleback



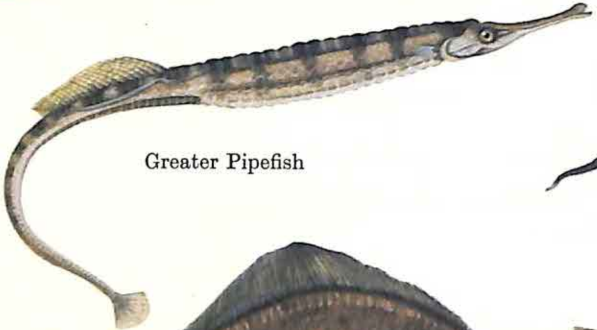
5-Bearded Rockling



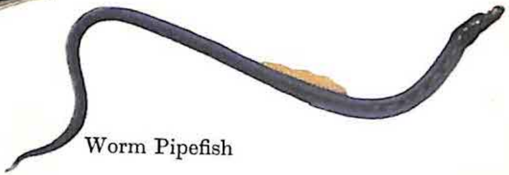
Corkwing Wrasse



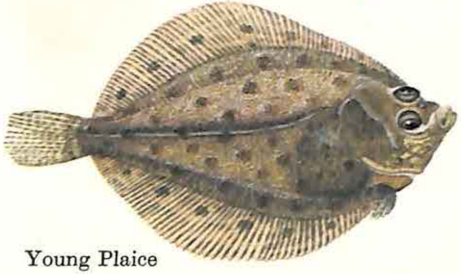
Snake Pipefish



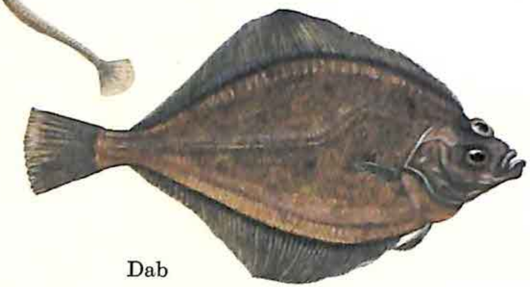
Greater Pipefish



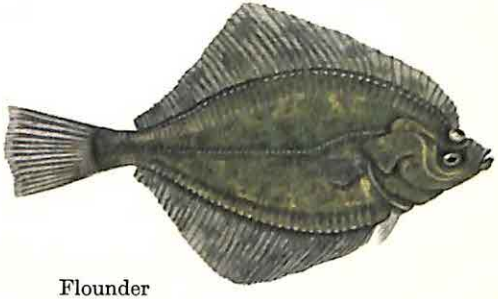
Worm Pipefish



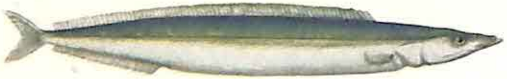
Young Plaice



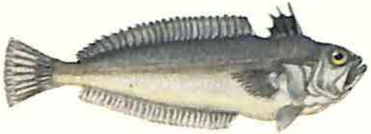
Dab



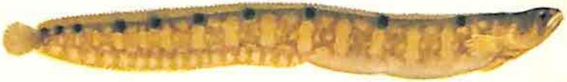
Flounder



Lesser Sand Eel



Lesser Weaver Fish



Butterfish

2076

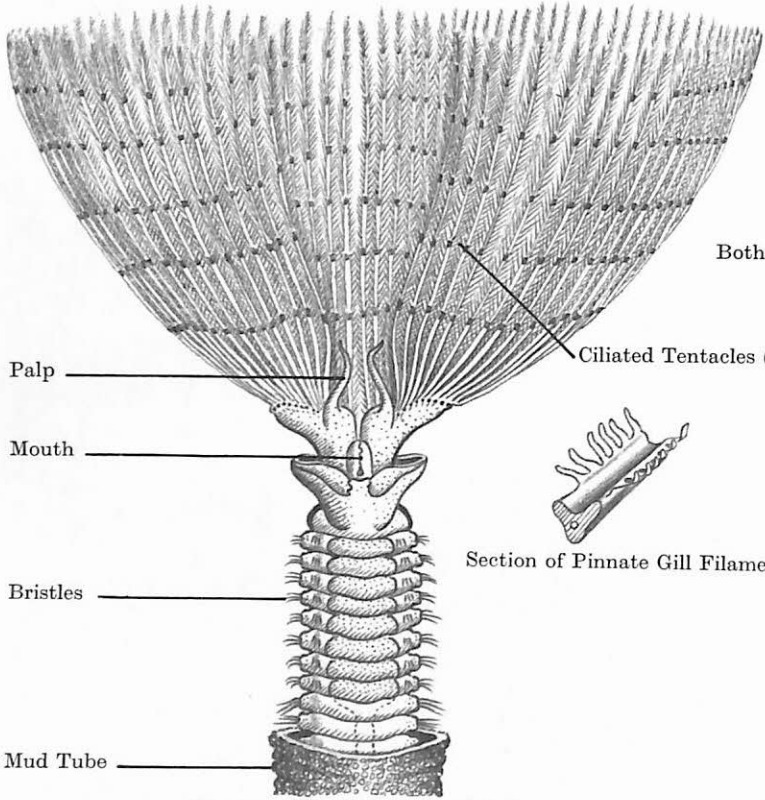
Estuaries and Sandy Beaches

When the tide is out, stretches of sand and mud are exposed. These, at first glance, appear devoid of life, but exploration with a fork and sieve soon reveals a whole new world of animals. They are, for the most part, very different from the rocky-shore inhabitants. Here, in the sand and mud, the animals are all *avoiders*, which escape from the disturbance of waves and tides, from the dangers of desiccation, and from sudden temperature and salinity changes by going underground. Below the surface, they find much more uniform and sheltered conditions. As on the rocky shore, the richest collections can be made at the low spring tides. Dig near low water and sieve through a fine mesh, shaking the contents gently in the water so that the grains of sand or mud wash away and the delicate animals that live among them are retained.

Date 31-8.05
11095

Sand Dwellers – a Design for Living

Many sand dwellers live in one place and draw a current of water towards themselves when covered by the tide. This water current is a life-line for such sedentary animals, providing food and oxygen and, in the case of worms, the particles for making their tubes. Thus their distribution is influenced by the amount of time the water covers them. A sedentary worm and mollusc are illustrated here. They are very different in structure but are adapted to meet much the same conditions of life. Both draw in currents of water by means of minute beating hairs, the *cilia*, which create the current and which act as filters and sorting mechanisms for the particles which they draw in. The worm's cilia are on its fan of tentacles and those of the mollusc are on its folded gills. At low tide the siphons of the mollusc are withdrawn into its shell and the tentacles of the worm into its tube.



Section of Pinnate Gill Filament

Diagram of the Tubeworm *Sabella*

Both four times life size

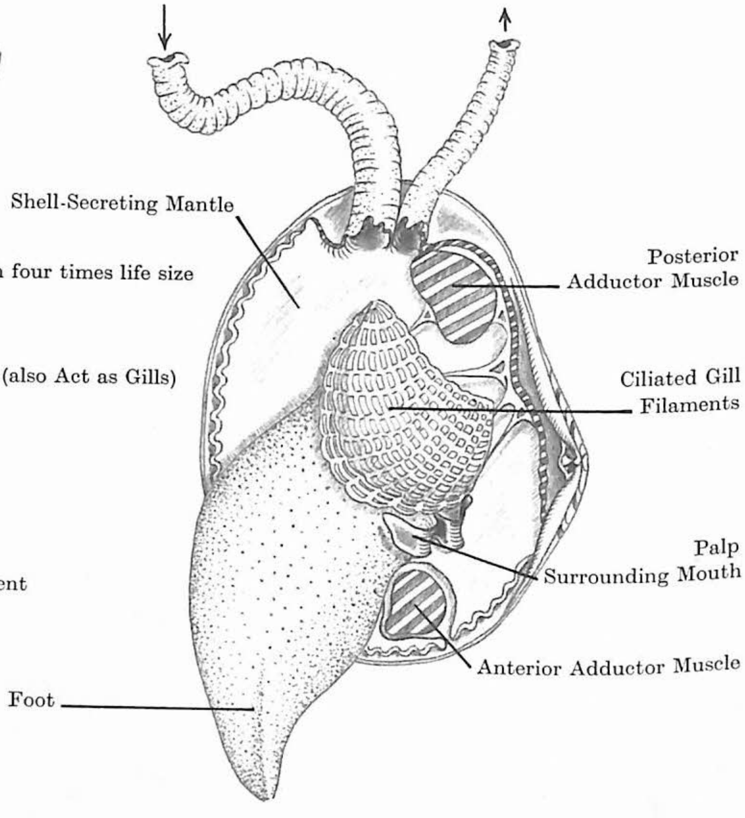
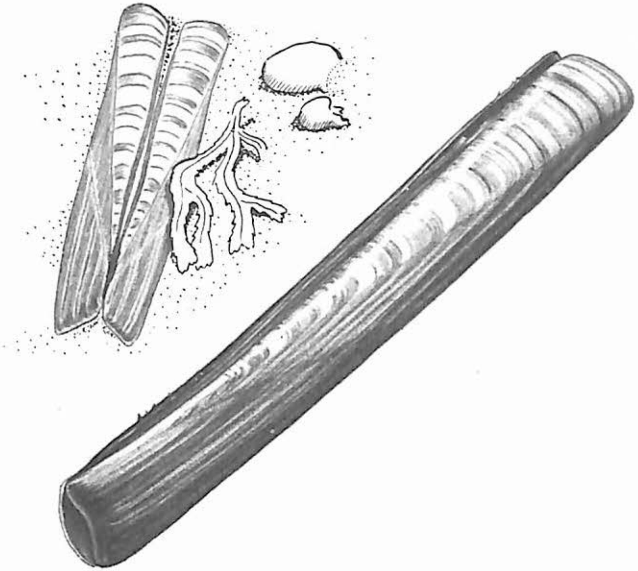
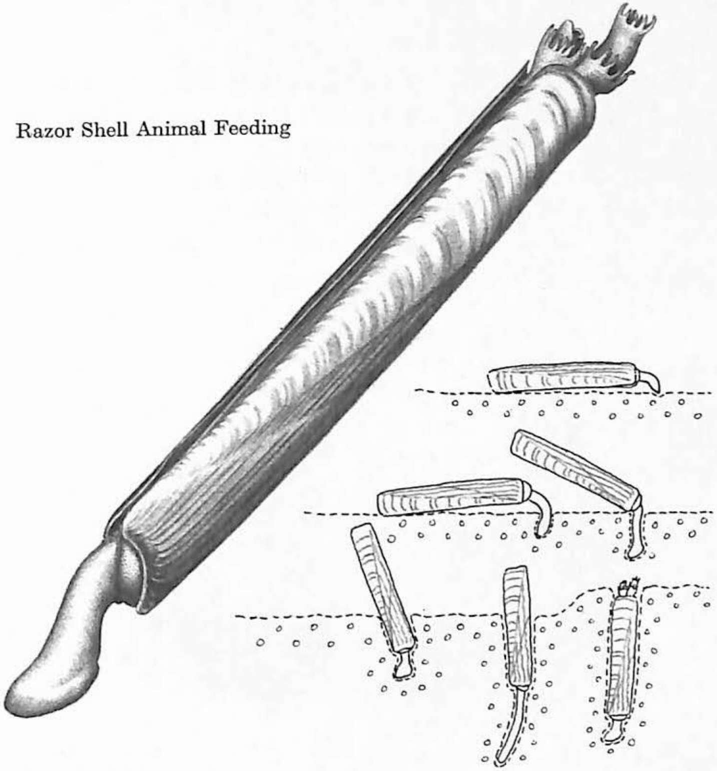


Diagram of the Bivalve *Tellina*

Razor Shell



Razor Shell Animal Feeding

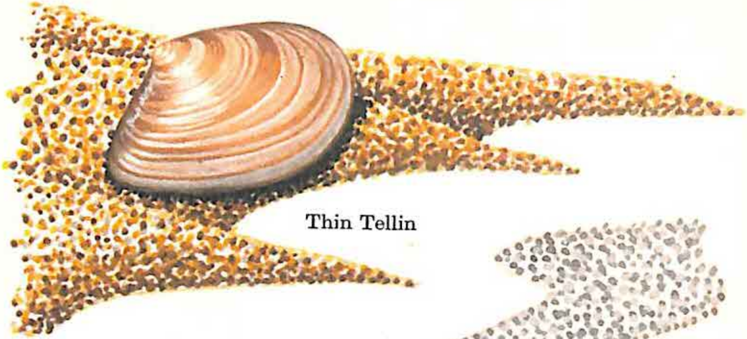


Hunting for Razor Shells

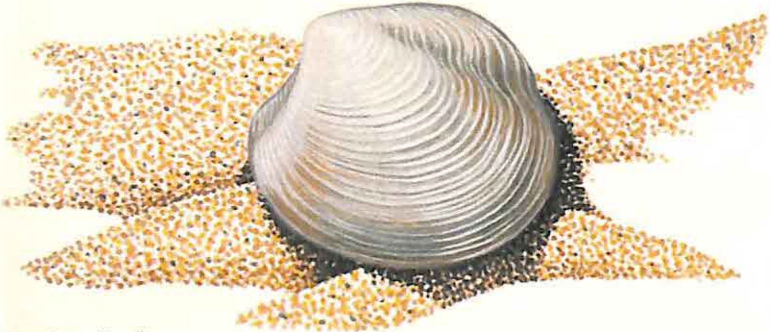
These are long, bivalve molluscs with shells shaped like cut-throat razors. Their empty shells are often found washed up on the beach, but the complete living animals occur in sand near the low-tide level. They are difficult to dig up because they burrow extremely rapidly. In the Channel Islands they are caught, almost literally, by 'putting salt on their tails'. This is done by finding one of their characteristic keyhole-shaped openings in the sand and placing a teaspoonful of table salt on it. After about a minute to a minute and a half there will be signs of disturbance and the tip of a siphon will begin to appear above the sand. If left untouched for a few more seconds, the animal will further free itself and can be pulled up easily and unharmed. Unlikely though this may sound, it is a far more certain way of catching them than by digging. Watch how they burrow by placing one, after capture, on the sand and seeing its muscular foot extending and pushing down into the sand with its pointed tip. This tip is then swollen to act as an anchor as the muscles of the rest of the foot contract. The shell is drawn into a vertical position – and a further repetition of this sequence of movements draws it rapidly into the sand.

Some Other Burrowing Molluscs

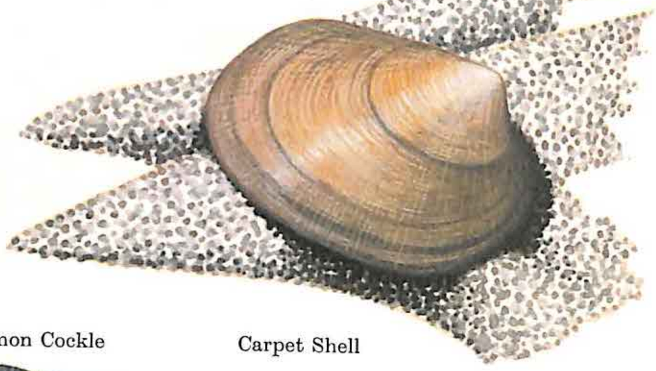
A few of the other bivalve molluscs you may find are illustrated here. These, when first dug up, will be tightly closed, but if you place them in a dish of clean sea water they may begin to gape and push out their siphons. These molluscs normally lead a relatively sheltered life, but they are liable to attack by wading birds, crabs, and flesh-eating predatory molluscs such as *Natica* which bore through their shell. They may also be disturbed by heavy seas, and sometimes, after gales, huge numbers of dying and damaged bivalves are found washed up on the beach.



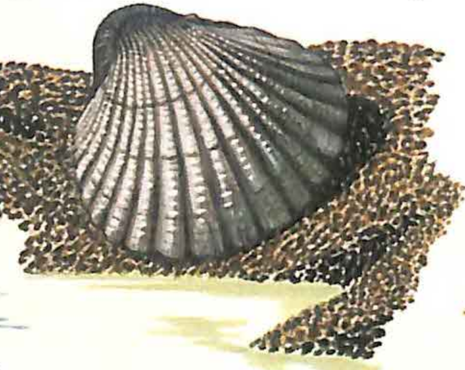
Thin Tellin



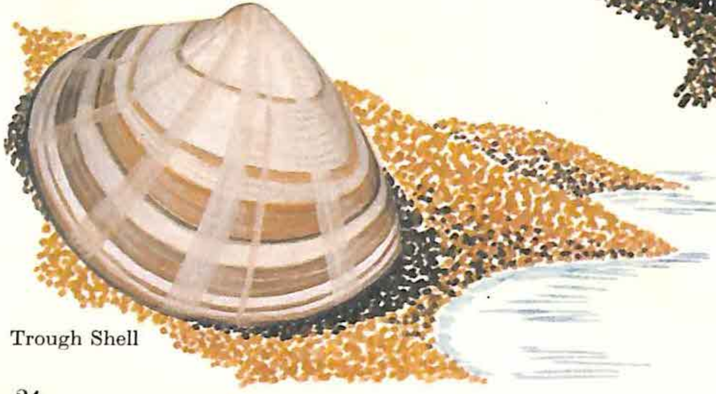
Northern Lucina



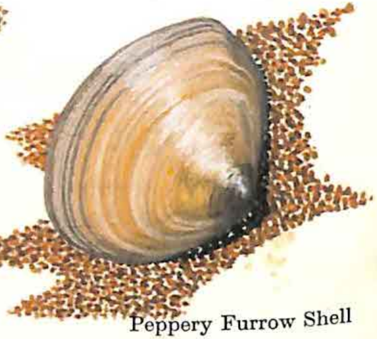
Carpet Shell



Common Cockle



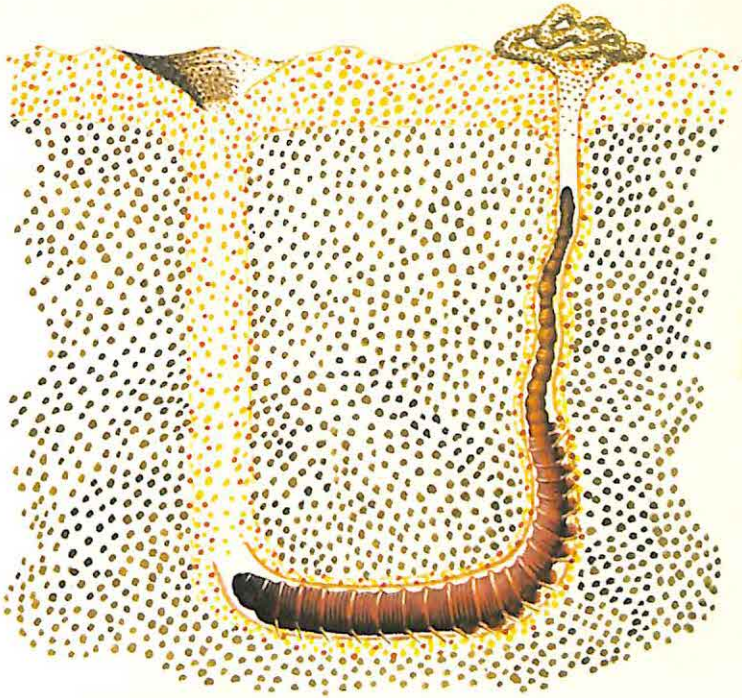
Trough Shell



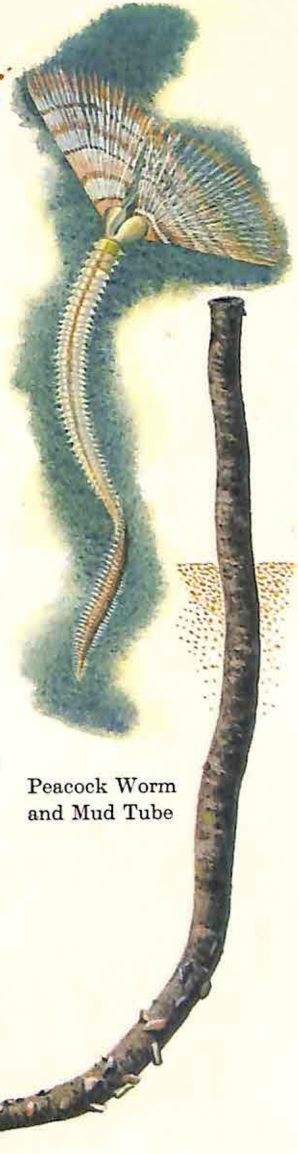
Peppery Furrow Shell

Worms of the Sand and Mud

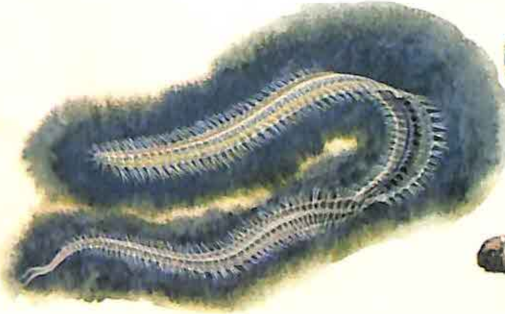
At low tide the only sign of the presence of sand worms is, in some cases, the tip of their protective tube sticking up above the sand. That of the peacock worm is formed of fine particles woven together with silky mucus and it has the consistency of bicycle-valve rubber. That of the sand mason is covered with shell particles and is drawn out at its tip to form a delicate fringe of sand-covered branches. When the water covers them, these worms spread their tentacles like the petals of a flower only to shoot them in again at the least disturbance or shadow. The fat, iridescent lugworm, which is well known as a bait worm, normally spends all its adult life beneath the mud. It draws fine particles into one end of its U-shaped burrow and passes out the waste as a sandy worm cast from the other end. Ragworms, also much used for bait, are sand and mud dwellers – but these are active, mobile forms and prey upon the sedentary worms. One of them, *Nephthys*, the white cat, is shown here.



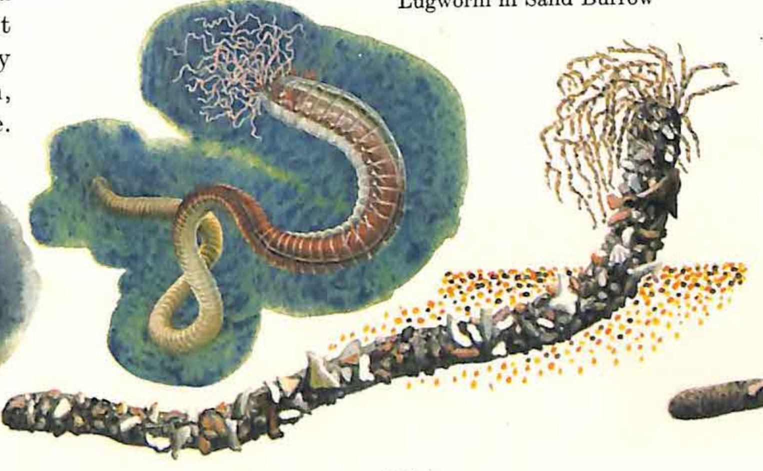
Lugworm in Sand Burrow



Peacock Worm and Mud Tube



White Cat Worm



Sand Mason and Mud and Gravel Tube

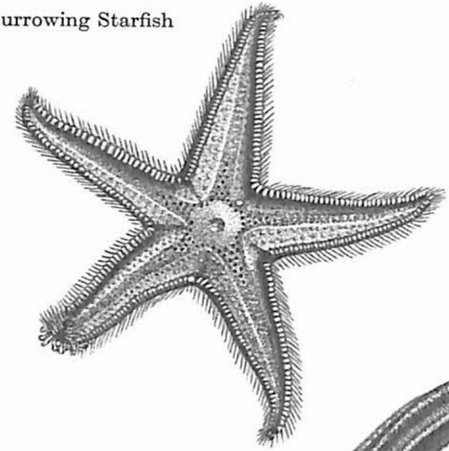
Burrowing Echinoderms

The four main groups of ECHINODERMS have each got sand-living representatives. If you dig near low water, you may turn up the heart urchin, *Echinocardium*. This is covered with greenish-yellow spines. It burrows to a depth of about eight inches and constructs a cavity in which it lives. It draws down food from the surface of the sand above. One of the brittle stars, *Acrocnida*, is a mud dweller, as is the burrowing starfish, *Astropecten*. Finally, look out for burrowing sea cucumbers such as *Lapidoplax*. These look rather worm-like at first but are not segmented and feel characteristically 'sticky' to touch because their skins are covered with tiny, hooked plates.

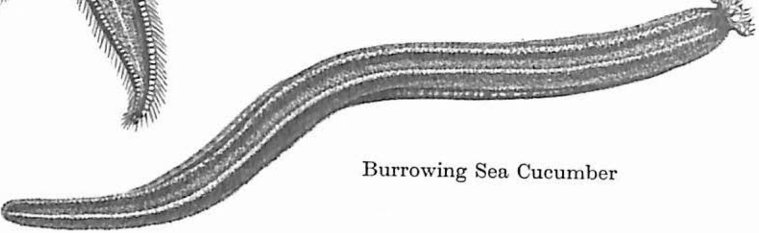
Crustacea of the Sandy Shore

Many CRUSTACEA live in the sand. Most common among the larger ones is probably the shrimp, *Crangon*, and among the most interesting is the masked crab, *Corystes*. This lives at the bottom of a sandy burrow. It forms a tube with its long, hairy antennae, down which it draws a current of water when the sea covers it. Rocks and stones on the surface of the sand flats frequently harbour hermit crabs, such as *Eupagurus* (see page 13). This usually occupies an empty whelk shell and one species often has the anemone *Calliactis* attached to the outside of this shell.

Burrowing Starfish

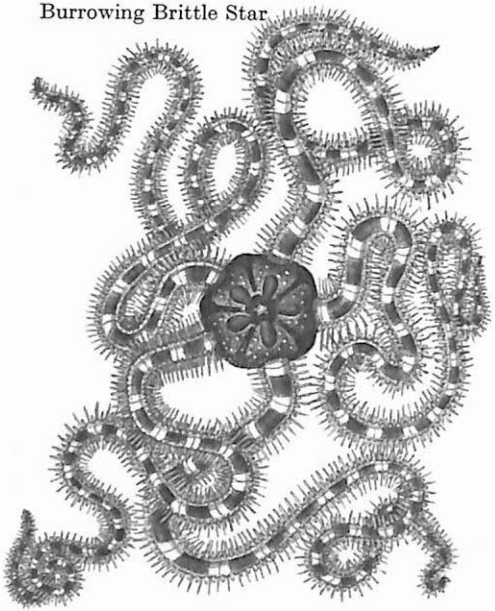


Heart Urchin

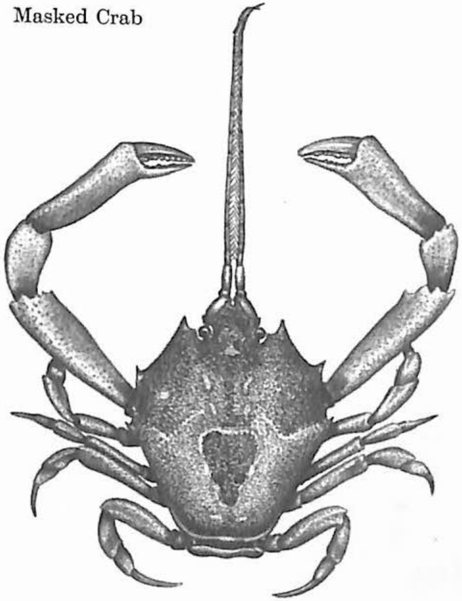


Burrowing Sea Cucumber

Burrowing Brittle Star



Masked Crab

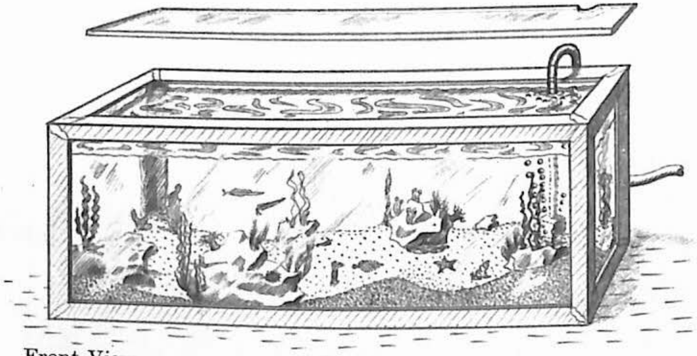


Your Own Aquarium

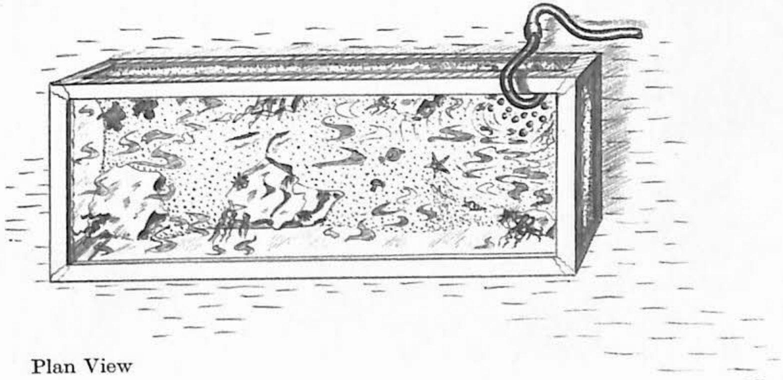
To set up your own simple sea-water aquarium, either buy a glass tank or else make a wooden, glass-fronted box and waterproof all the wood surfaces with bituminous paint. Within your tank, arrange a background of clean, well-scrubbed stones and cement the largest of these in place. Rinse the tank and its contents thoroughly with clean water, then place a layer of coarse, well-washed sand particles on its floor. Avoid silt or dusty sand as this will result in cloudy water. Fill the tank carefully with filtered sea water and cover it with a glass or plastic lid in order to reduce evaporation.

Your tank is now ready to stock. Many sea anemones, hydroids, and sponges will survive well in captivity as will dog whelks and mussels. The larger sea squirts, such as *Ciona*, usually thrive, and so do many echinoderms. Crustaceans, such as small shore crabs, hermit crabs, and barnacles are interesting to keep. Study the feeding habits of the animals which you introduce into your tank. Crabs and blennies, for example, are very voracious and they will devour the smaller animals if given the chance. Wrasse and dog whelks will make short work of barnacles, while prawns, shrimps, and squat lobsters are valuable scavengers, and mussels, sponges, and sea squirts keep the water well filtered.

Animals thrive better if the water is aerated with a simple pump. This not only oxygenates the water but keeps it circulating, which is important. To maintain your tanks successfully, see that they are kept at a cool, steady temperature and, most important of all, avoid *overcrowding*. Blennies, gobies, and flatfish will only do well if not more than one or two are kept in the average small aquarium and, if you wish to keep an octopus or a cuttlefish, it is best to give it a tank to itself. Do not overfeed the animals (once a week is quite sufficient) and remove any uneaten remains within two hours of feeding. Use a long glass pipette or a pair of wooden forceps to do this and remember to remove any specimens that look at all sickly so that they do not pollute the water. Do not introduce large seaweeds; microscopic encrusting ones, which will settle out from the water, will provide all the plant material required. Top up with distilled water periodically to make up for losses due to evaporation using a hydrometer – sp. gr. = 1·025.



Front View



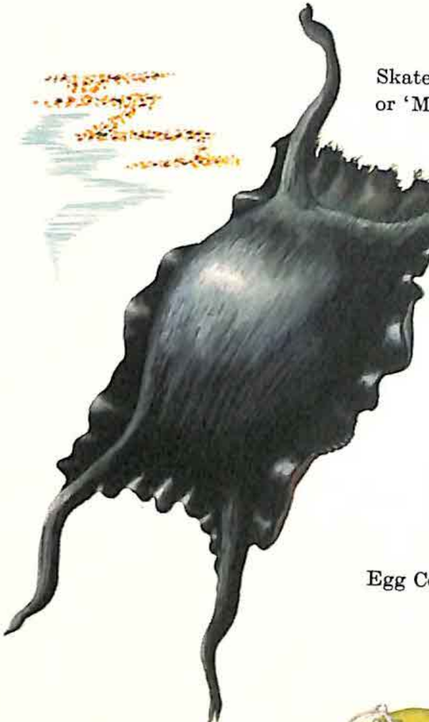
Plan View

Eggs and Egg Cases of Shore Animals

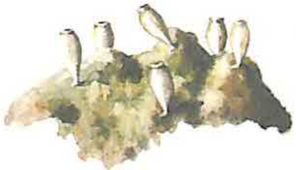
A few shore animals such as the viviparous blenny and the rough periwinkle give birth to miniature, fully formed young. Others lay fairly large eggs which are provided with stores of yolk – some of which are described here – and many others, including the limpet and the nerite winkle, produce clouds of minute eggs which are carried out to sea and hatch there.

Mermaids' purses are the leathery shelled eggs of the skate and the dogfish. Empty ones may be found washed up near the strandline, but the unhatched eggs which each contain a young fish and its supply of yolk occur near the very low-water mark attached by their tendrils to the seaweeds. Sandy-coloured egg masses of the common whelk, about the size of tennis balls, are also often washed up. One of these masses is illustrated on page 7. Dog whelks' eggs, which are shown on this page, occur cemented to the rocks like small groups of wheat grains, whereas those of the netted whelk are to be found on fronds of seaweed (especially on eel grass) arranged side by side, as shown here. The necklace shells lay curved ribbons of eggs about one inch wide and mingled with sand grains. Eggs of sea slugs are very varied in form and colour. Those of the sea hare and the sea lemon are shown here.

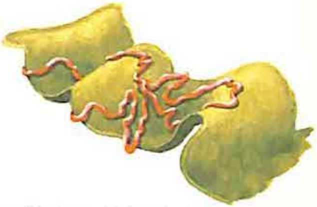
Some shore animals, such as blennies and butterfish, guard their eggs until they hatch. Female crabs and prawns 'in berry' carry their eggs cemented to their small abdominal limbs, whereas in sea spiders and pipefish, as in sea horses, it is the males that carry the eggs with them and do the 'baby-watching'.



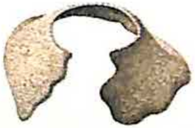
Skate's Egg Case
or 'Mermaid's Purse'



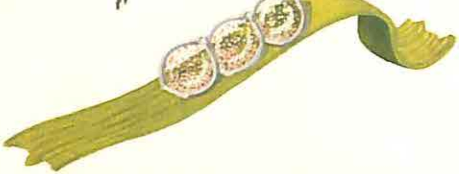
Eggs of Dog Whelk



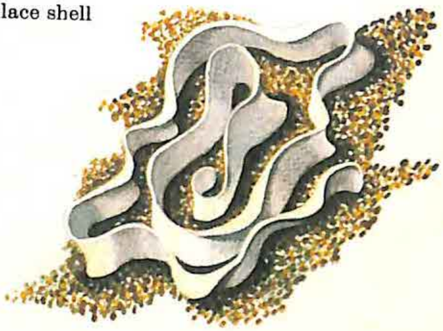
Egg String of Sea Hare



Egg Collar of Necklace shell



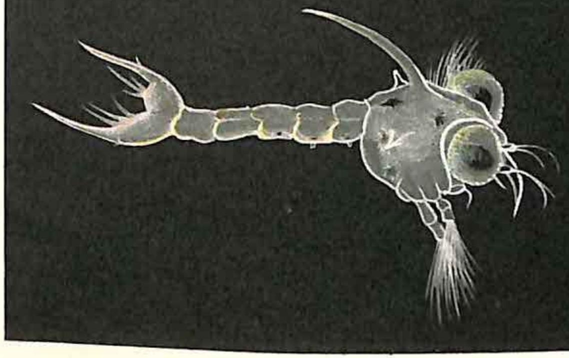
Egg Purses of Netted Whelk



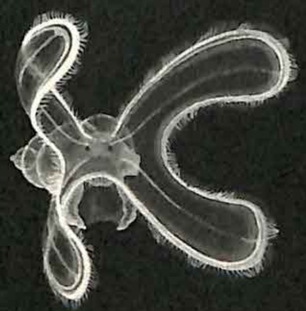
Egg Ribbon of Sea Lemon

Early Stages – Larval Life

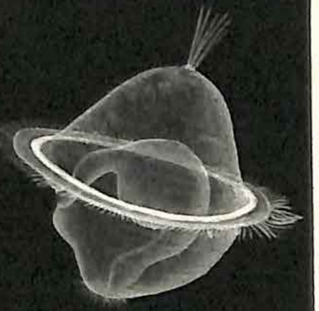
Few shore animals spend their whole life on one beach. Many hatch as minute larvae – that is, as forms which differ greatly from the adult in structure and appearance (in much the same way as a caterpillar differs from a butterfly). The larval stage of shore animals provides an opportunity for them to spread and colonize new areas before settling down to a sedentary or semi-sedentary adult life. Such animals start life as microscopic floating eggs. These and the minute larvae which hatch from them form part of the plankton. They can be collected by towing a very fine silk or nylon net through the surface sea water a short distance offshore. This can be done from a boat or while swimming. When you have washed out your net carefully and thoroughly in a tall jar of clean sea water you can examine your haul. If you look carefully you will probably be able to see a myriad of minute, transparent creatures swimming about on the water. This is the world of plankton – tiny delicate plants and animals that abound in the coastal waters and which form the food of tubeworms, barnacles, sponges, tunicates, and many other shore animals. The larger organisms will be just visible without a lens, but most of the catch needs to be seen under a microscope. Some larval stages are illustrated on this page. Notice structural features such as spines, hairs, or a broad, flat shape that help them to maintain their position near the surface as they swim. Some, like the crab larva shown here (1), have large eyes. The small worm *trochophores* (2) and the mollusc *veligers* (3) have bands of delicate, beating hairs which cause them to move through the water. Some live on stores of yolk carried over from the egg, but most feed voraciously, chiefly upon the even more minute plant life floating in the water. If you have a microscope, you may like to try rearing the early stages of some shore animals such as limpets, nerite winkles, or coat-of-mail shells. This can be done quite easily in many cases provided that you use very clean utensils and clean sea water. Place three or four animals in each dish during their breeding season (in many cases this is in spring) and watch for the release of microscopic eggs and a cloud of even smaller sperm. Then pick out the developing stages at intervals using a clean pipette. Many can be reared to quite an advanced stage in this way and once you have mastered the method there is an almost infinite field of fascinating study open to you.



Zoea Larva of Shore Crab ($\frac{1}{16}''$)



Veliger Larva of Netted Whelk ($\frac{1}{20}''$)

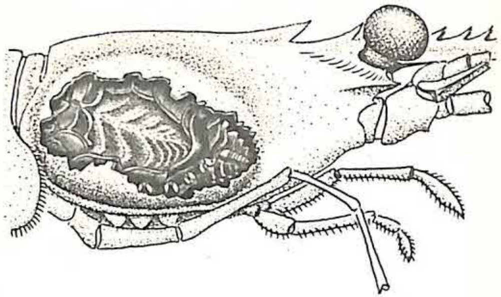


Trochophore Larva of Annelid Worm ($\frac{1}{32}''$)

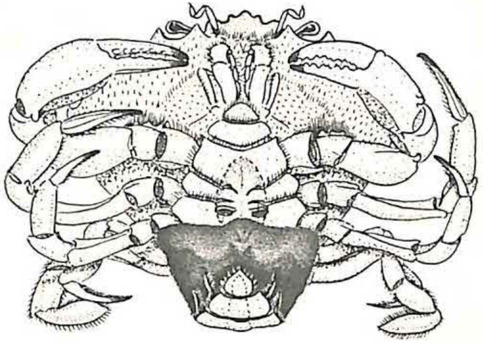
Parasites

Parasites are animals that get their food and shelter at the expense of another living animal, their host. Practically every group of animals has its parasitic members, but it is sometimes impossible to tell to which group a parasite belongs just by looking at the fully grown specimen. This is true of the parasite *Sacculina* which has the shore crab as its host. If you find it, you will see a fleshy knob sticking out just below the crab's 'tail' and from this 'rootlets' run out to all parts of the crab's body. It would be impossible to tell what kind of animal this parasite really is except for the fact that its eggs hatch out into typical barnacle larvae and show that really *Sacculina* is itself a strange sort of barnacle.

Another crustacean parasite that you may be lucky enough to find is *Bopyrus*. This lives beneath the hard carapace of prawns and is known as 'face-ache' because of the 'swollen-faced' look which it gives them. *Bopyrus* is really a kind of parasitic sea slater and its identity is also given away by its larva.



The Parasite *Bopyrus* under the Carapace of a Prawn ($\frac{1}{3}''$)



The Parasite *Sacculina* on the Underside of a Shore Crab

Enjoying the Seashore

In this book we've had a brief glimpse of new ways of enjoying the seashore. Its study can become a hobby and an absorbing interest. Much is known and many books have been written about it, but there still remains a vast amount that the experts want to know even about the commonest animals and plants. Perhaps you can add to knowledge by studying them and recording which occur and which appear to be absent on the beaches that you know. Populations are always changing. This book has mentioned how some animals, such as the barnacle *Elminius* and the oyster drill, have spread in recent years. Sometimes severe winters have wiped out whole populations in certain areas. Again, little is known of the seasons when animals spawn or to what extent spawning is influenced by water temperature, tidal conditions, and geographical situation. Keep a notebook and record the things you see. Find out all you can about the habits of shore creatures – their food, their length of life, their breeding season. Perhaps you will find that only by drawing and painting them can you capture the reality of the things you study, or your hobby may lead you to shore photography or building up your own museum. Along whatever path your interest leads you, train yourself to keep written records because these will become very valuable to you as your hobby develops.

Scientific names of the species illustrated in this book – those of the animals are based on the *Plymouth Marine Fauna*, third edition, 1957. Do not reject an identification on grounds of colour alone if it appears correct in other respects, as coloration often varies greatly within a single species.

PISCES

(Fishes)
Ammodytes tobianus LESSER SAND EEL
Blennius pholis COMMON BLENNY
Cottus bubalis SEA SCORPION
Crenilabrus melops CORKWING WRASSE
Cyclopterus lumpus LUMPSUCKER
Entelurus aequoreus SNAKE PIPEFISH
Gasterosteus aculeatus THREE-SPINED STICKLEBACK
Lepadogaster lepadogaster CORNISH SUCKER-FISH
Limanda limanda DAB
Liparis montagui MONTAGU'S SEA SNAIL
Nerophis lumbriciformis WORM PIPEFISH
Onos mustelus ROCKLING
Pholis gunnellus BUTTERFISH
Platichthys flesus FLOUNDER
Pleuronectes platessa PLAICE
Spinachia spinachia FIFTEEN-SPINED STICKLEBACK
Syngnathus acus GREAT PIPEFISH
Trachinus vipera LESSER WEAVER FISH

CRUSTACEANS (Crabs, prawns, barnacles, etc.)

Balanus balanoides ACORN BARNACLE
Bopyrus fougerouxi 'FACE-ACHE'
Cancer pagurus EDIBLE CRAB
Carcinus maenas SHORE CRAB
Chthamalus stellatus ACORN BARNACLE
Corystes cassivelanus MASKED CRAB
Elminius modestus ACORN BARNACLE
Eupagurus bernhardus HERMIT CRAB
Galathea strigosa SQUAT LOBSTER
Idotea sp.
Jaera sp.
Ligia oceanica SEA SLATER
Orchestia sp. SANDHOPPER
Palaemon serratus PRAWN
Porcellana platycheles FLAT-CLAWED CRAB
Portunus depurator SWIMMING CRAB
Portunus puber VELVET FIDDLER CRAB
Sacculina carcini
Sphaeroma sp.
Verruca stroemia ACORN BARNACLE

MOLLUSCS

(Bivalves, snails, coat-of-mail shells)
Acanthochitona crinita HAIRY CHITON
Acmaea tesselata TORTOISESHELL LIMPET
Anomia ephippium SADDLE OYSTER
Aplysia punctata SEA HARE
Archidoris pseudoargus SEA LEMON
Bittium reticulatum NEEDLESHELL
Buccinum undatum COMMON WHELK
Calliostoma zizyphinum PAINTED TOPSHELL
Cardium edule COMMON COCKLE
Chlamys varia HUNCHBACK SCALLOP
Clathrus clathrus COMMON WENTLETRAP
Crepidula fornicata SLIPPER LIMPET
Diodora apertura KEYHOLE LIMPET
Dosinia lupinus SMOOTH ARTEMIS
Ensis sp. RAZOR SHELL
Gibbula cineraria GREY TOPSHELL
Gibbula magus GREATER TOPSHELL
Gibbula umbilicalis FLAT TOPSHELL
Glycymeris glycymeris DOG COCKLE
Haliotis tuberculata ORMER
Lepidochitona cinerea SMOOTH CHITON
Littorina littoralis FLAT PERIWINKLE
Littorina littorea COMMON PERIWINKLE
Littorina neritoides NERITE PERIWINKLE
Littorina saxatilis ROUGH PERIWINKLE
Lucinoma Borealis NORTHERN LUCINA
Mactra corallina COMMON TROUGH SHELL
Monodonta lineata THICK TOPSHELL
Mytilus edulis MUSSEL
Nassarius incrassatus THICK-LIPPED DOG WHELK
Nassarius reticulatus NETTED DOG WHELK
Natica alderi COMMON NECKLACE SHELL
Nucella lapillus DOG WHELK
Ocenebra erinacea STING WINKLE
Patina pellucida BLUE-RAYED LIMPET
Patella vulgata COMMON LIMPET
Scrobicularia plana FURROW SHELL
Sepiola atlantica LITTLE CUTTLE
Spisula elliptica ELLIPTICAL TROUGH SHELL
Tellina tenuis THIN TELLIN
Trivia arctica ARCTIC COWRIE
Trivia monacha EUROPEAN COWRIE
Urosalpinx cinerea OYSTER DRILL
Venerupis decussata CARPET SHELL
Zirphaea crispata OVAL PIDDOCK

ANNELIDS

(Ragworms and tubeworms)
Arenicola marina LUGWORM
Eulalia viridis GREEN RAGWORM
Lanice conchilega SAND MASON
Nephthys hombergi WHITE CAT
Pomatoceros triqueter
Sabella pavonina PEACOCK WORM
Spirorbis borealis

ECHINODERMS

(Starfishes, sea urchins, etc.)
Acrocnida brachiata BURROWING BRITTLE STAR
Antedon bifida FEATHER STAR
Asterina gibbosa CUSHION STAR
Astropecten irregularis BURROWING STARFISH